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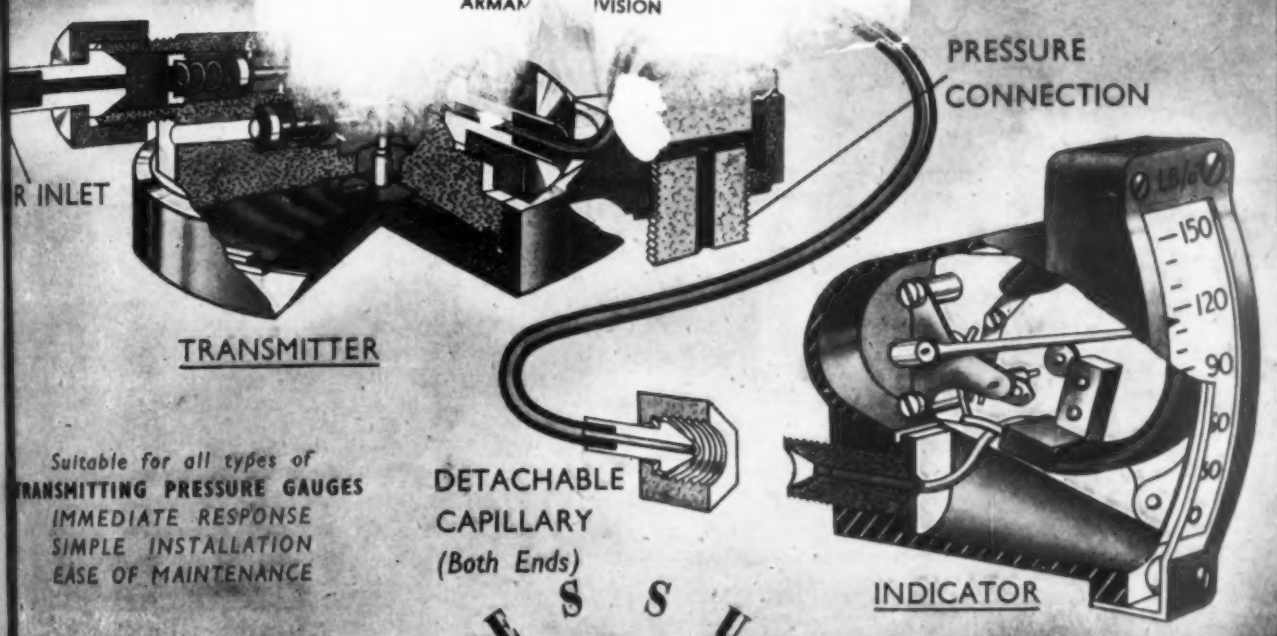

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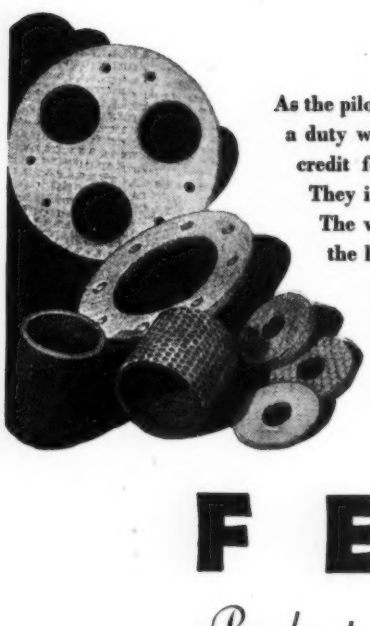

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FLIGHT and The AIRCRAFT ENGINEER

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The Outlook

Hammer and Tongs

ON February 22nd the Prime Minister said: "We intend to make war production in its widest sense impossible in all German cities, towns and factory centres." Recent events have shown that Bomber Command and the U.S. 8th Air Force are well on their way to make good Mr. Churchill's words. The fitting of some Mosquitoes to take the 4,000 lb. bomb will help to hasten the process.

The American force of heavy bombers now begins to surpass that of Britain, large though the latter is, and it continues to increase at a rate which more than compensates for its losses in action. The result is seen in the hammer-and-tongs attacks which the two bomber forces have been making on German production, and especially on the production of fighter aircraft. No sooner has a devastating night attack by the British finished than the Americans start out with an escort of formidable long-range fighters to batter another production centre.

The dilemma in which the *Luftwaffe's* fighter branch finds itself would be almost amusing, if anything in war could be described in that way. The first-line fighters are continuously suffering losses in action, in addition to normal wear and tear. These will be replaced at once from the immediate reserves, and those reserves likewise will be replenished from the stores depots. We cannot assume that the depots have yet been depleted; but they depend on the factories to keep up their stocks, and lately quite a number of factories have gone out of business.

Every battle with the American escorts means the loss of so many German fighters; yet, if they do not fight, the factories on which they depend will go out of action at a rate still faster than that hitherto achieved. Some cities must also be defended at all costs. It is all a question of priorities, and it has become clear that fighter cover in Russia, in Italy and over most of occupied France has been sacrificed in order to avoid losses and to keep a fighter reserve of some strength in hand. Another consideration must be the physical strain on the German fighter pilots, who cannot work all round the clock.

The relentless American pressure continues, forcing the Germans' hand. Sometimes the latter take a day off, and allow the Americans to do their worst, except in so far as *flak* can restrain them; but that cannot be allowed to go on for long. Soon the Germans must go up again and fight, and lose more machines and more pilots.

Power for the Helicopter

HONOURS for being the first aircraft engine firm to announce a special helicopter engine appear to go to the Aircooled Motors Corporation, of Syracuse, New York. Few details have been disclosed, but it would appear likely that the firm in question has merely taken one of its existing "flat six" engines, stood it on end, and possibly modified the lubrication system slightly, and finally so enclosed it in a baffled box that fan cooling can be employed.

Superficially one might be inclined to think that it is full early yet to produce engines specifically for helicopters. But is it? To us it appears that the two fundamentals still to be satisfactorily evolved are, first, the rotor head (no 100 per cent. head is yet in use), and, secondly, a suitable power plant.

The enthusiastic claims made by supporters of the helicopter conveniently overlook the fact that rotor heads are still far too complicated. That drawback might be excused if they worked perfectly. But they do not. There is still far too much vibration, rotor resonance

and things of that sort. The "shimmy" being transmitted to the control column is still something more than a mild nuisance. And, worst of all, the skill required of the pilot to make a vertical ascent or descent on a gusty day is more than considerable.

Almost as important is the question of helicopter power plants. It was natural that hitherto helicopter designers should make use of existing engines.

The Franklin engine is a six-cylinder opposed air-cooled type. When "stood on end" it remains symmetrical. That would not be the case with either a straight six or with any type of in-line vee engine. The radial therefore appears to be the logical solution.

In view of the fact that the engine of a helicopter will be in the fuselage, and will thus be "buried," it might well be that the radial liquid-cooled type of engine might be worth reviving. We use the word advisedly, for although it may be news to our younger readers, there was a water-cooled radial in the early days of flying, the Salmson Canton Unne, built under licence in this country by the Dudbridge Iron Works.

Perhaps our engine designers may care to think the matter over.

"The Most Fearful Form of Warfare"

MR. CHURCHILL in his public pronouncements seems always verging on the point of representing the Anglo-American bomber offensive as a punishment which the Germans have brought upon themselves by their blitz on Britain in 1940, and their bombings of Warsaw, Rotterdam and Belgrade; yet he never goes so far as to say so. His words last Sunday were: "We have endured without swerving and failing the utmost fury which Hitler could cast upon us from the air, and now the tables are turned, and those who sought to destroy their enemies by the most fearful form of warfare are themselves reeling and writhing under the prodigious blows of British and American air power."

It would certainly be beyond human forbearance to refrain from recalling Hitler's threat that "we will raze their cities to the ground," and not to feel some sense of justice that the boot is now on the other leg. Circumstances, of which Hitler himself was the chief item, have made it possible for the Prime Minister to speak as he does with a clear conscience. Hitler, in fact, played into Mr. Churchill's hands.

Many years ago the policy of establishing a striking force of bombers was accepted in this country; and it may be added that this was the only country which conceived the idea of using bombers as an important attacking force. It was certain that in another war we should have continental allies, and as our Army was tiny it was felt that a striking force of bombers would be the best contribution we could make to their land campaign. It is not certain that we then contemplated an attack on enemy production, though the history of the Independent Air Force in 1918 suggested that we would do so.

If the Germans had never done what they did, and we had done what we are doing, bombing would still be the most fearful form of warfare, but no hint of just punishment could have entered into our descriptions of it. But this great difference between German and Allied use of bombers must never be forgotten. We are attacking production as a stark necessity of war, while Hitler can never claim that his use of bombers had that excuse.

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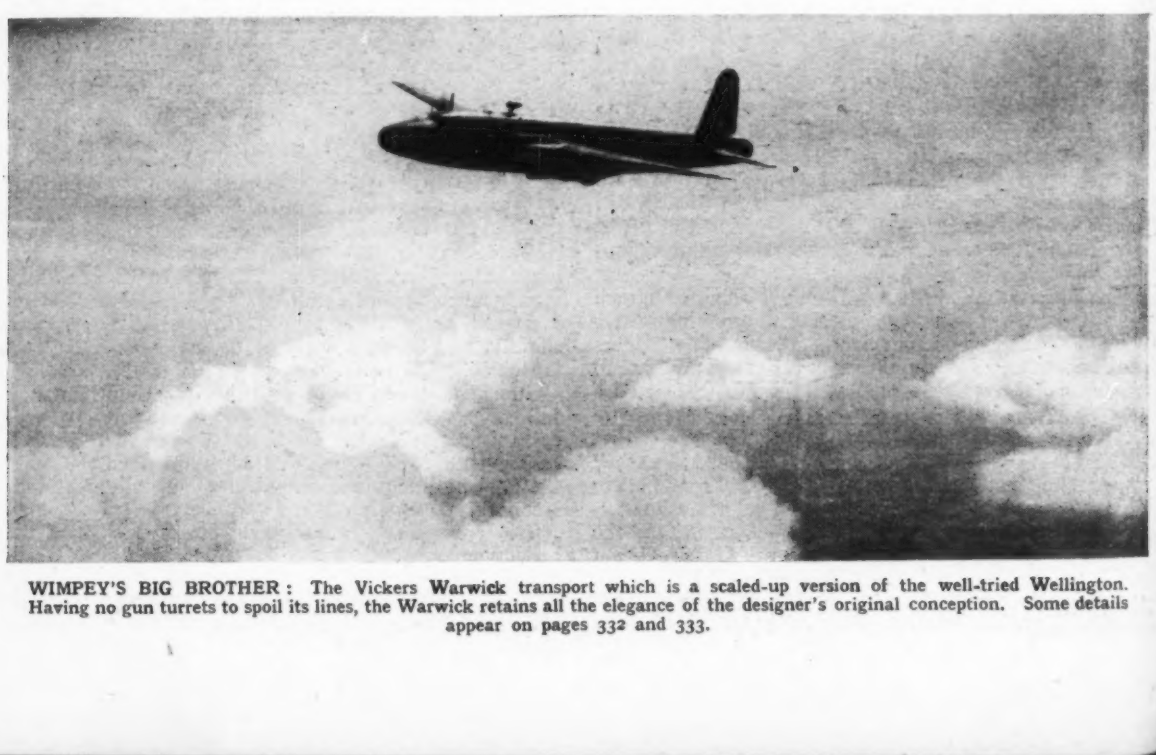


WIMPEY'S BIG BROTHER: The Vickers Warwick transport which is a scaled-up version of the well-tried Wellington. Having no gun turrets to spoil its lines, the Warwick retains all the elegance of the designer's original conception. Some details appear on pages 332 and 333.

I.A.F. IN ACTION: Squadrons of the Indian Air Force, flying Hurricanes and Vengeances, are supporting the Fourteenth Army in Burma.

WAR in the AIR

The Cassino Problem : "Token Invasion" of India : The Bombing Offensive Grows by Day and Night

THOUGH the recent air bombing of Cassino reduced the place to heaps of rubble, as the Army had desired, this did not mean immediate occupation of it by the New Zealanders. The incident recalls many cases in the first world war when British artillery pounded the German front trench lines out of all recognisable resemblance to a defence position, and yet when our infantry advanced they found themselves under the fire of machine guns which had been dragged up from deep dug-outs.

In the case of Cassino much the same thing happened, with this additional complication that before the bombing started our infantry had to be withdrawn to a safe distance. Among the hills there could be no question of them following up a creeping barrage as they used to do on the plains of Flanders in 1918. Heavy bombers were among the multitudinous aircraft on the job, and their missiles were more destructive but less accurate than those of the mediums, and so the infantry had to keep away from the vicinity. A near miss with a heavy bomb may well spread destruction lower down the hill. Then as the aircraft flew away our guns sprayed the surroundings of the place to catch any Germans who might have scattered, and this was another reason for keeping our infantry at a distance.

Accordingly, after artillery and aircraft had each in turn done their best to win the battle of Cassino, the affair resolved itself once again into an infantry struggle. So it must always be, it seems, in mountain warfare.

POISONOUS FUNGUS: A Japanese ammunition dump on Bigej islet, Marshall Islands, after being shot up by low-flying American fighters.

Fighting in Burma

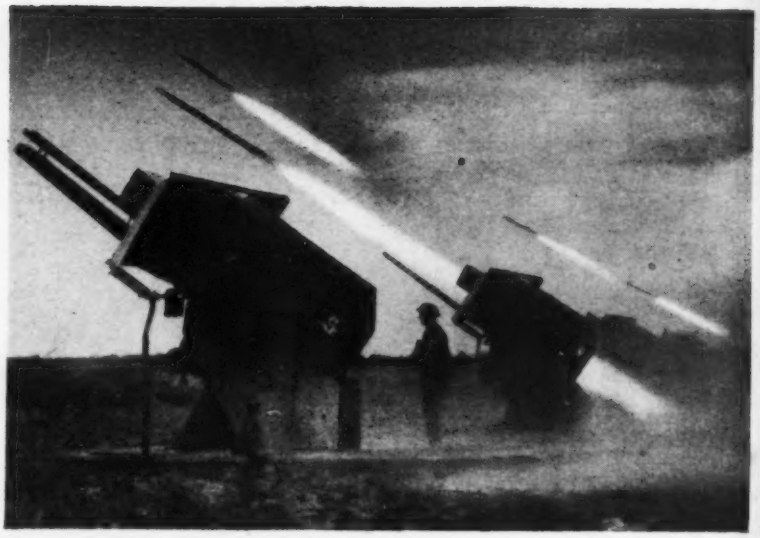
THE Burma campaign is now attracting more attention than it has done for a long time past. The Japanese are said to have crossed the frontier into India, or, more precisely, into the State of Manipur, which is part of the Indian Empire. The Commander-in-Chief, Gen. Sir Claude Auchinleck, has rightly pointed out that this is not significant in any way. He called the enemy's strong raiding columns "a token invasion of India."

No surprise need be felt that a period of silence should follow the announcement of the landing of airborne troops behind the Japanese lines. Naturally we do not intend to give the enemy any information about their position (though he must have discovered that before very long) or the object for which they were despatched. What news has been published makes it clear that the force was elaborately equipped, and it was even mentioned that a number of pack mules were carried in the gliders.

Airborne troops have been used be

WAR IN THE AIR

fore in this war. The case of Crete need not be considered, because the circumstances there were exceptional, and everything favoured the success of the invaders, provided that they were willing to pay the price in casualties, which the Germans are never reluctant to do. We tried experiments with air-borne troops in Sicily, and it was admitted that mistakes were made, even though General Montgomery said that the air-borne men had saved the Eighth Army a week in establishing itself on the island. It is to be hoped that the South-East Asia Command has profited by the lessons learnt from the earlier experiments. One rule seems to be (though rules can only be put forward tentatively as yet) that air-borne troops must meet with rapid success, for otherwise they may become a liability instead of an asset. The conditions of Burma are doubtless peculiar, and as the enemy there is very weak in the air the supplying of an air-borne contingent may be easier there than elsewhere. The Wingate Force was supplied by air, and the same service has been rendered to Australians in New Guinea, so presumably the force in Burma can be served in the same way. But it will evidently have to travel a long way before it can achieve its object, whatever that may be, and one does not like to think of all the possible difficulties which may crop up to interfere with the adequate supplying by air of a considerable force, which would find itself in a very difficult position if its unusual line of communications were seriously interrupted. Properly used, however, this force may accomplish great things.



FOR GERMAN AIR TOURISTS : The Z rocket guns—newly released from secrecy —which are guaranteed to give any marauding German a hot reception.

Although there is a general feeling of confidence that the Battle of the Atlantic has gone definitely in favour of the United Nations for the time being, all naval and air authorities know well that vigilance must not be relaxed for a minute. The Germans will always be quick to stage a comeback if the British and Americans give them a chance. Therefore it was pleasing to learn recently that the United States has supplied Britain with 38 escort carriers on Lend-Lease terms. Col. Knox has stated that the U.S. Navy now possesses about 50 of these invaluable vessels. It does not matter much whether they are in the hands of American or British crews, so long as they serve the common purpose by defeating the enemy U-boats.

THEIR PLACE IN THE SUN : Indian pilots of an I.A.F. Hurricane squadron resting on a forward airfield. The man wearing a *pagri* is a Sikh.

Red Air Scouts

Some weeks-ago it was pointed out in these columns that no small part of the Russian ability to bring off surprises by striking now here, now there, and always out-manœuvring the Germans, must be due to the air superiority which our Allies have now established. Reconnaissance is of the essence of surprise, or of countering surprise, in war, and the Russian Generals obviously have good information as to the movements of their opponents, while the Germans often appear to be quite in the dark. The Russian freedom to reconnoitre from the air would account for this.

Altogether the *Luftwaffe* in Russia must be having a very unhappy time. It is extremely short of fighters, which means that its bombers are subject to heavy casualties when they try to interfere with the movements of the Russian troops. Quite recently it was reported that the *Luftwaffe* was trying to cut the communications of Marshal Konev across the river Dniester. It would be natural for the retreating Germans to use any and every weapon to try to check this remarkable advance of the Red Army; but it does not appear that the *Luftwaffe* was able to do much. In fact, if we judge by the numbers of aircraft which are claimed as destroyed in the Russian communiqués, not very many German machines can be taking the air on any day. On the other hand, one does read every now and then of good work carried out by the Stormoviks against the German troops. These Russian tactical bombers must be well protected by fighters (for the production of aircraft in Russia is now

ENEMY AIR LOSSES TO MAR. 25th

	Over G.B.	Continent	Middle East	Italy
Mar. 19 ...	10	0	0	32
,, 20 ...	0	1	0	7
,, 21 ...	11	3	0	4
,, 22 ...	1	1	0	7
,, 23 ...	1	2	0	2
,, 24 ...	8	2	0	19
,, 25 ...	0	0	0	0
	31	9	0	71

Totals : West, 8,119 ; Middle East, over 5,845 ; N.W. Africa and Italy, 4,852.

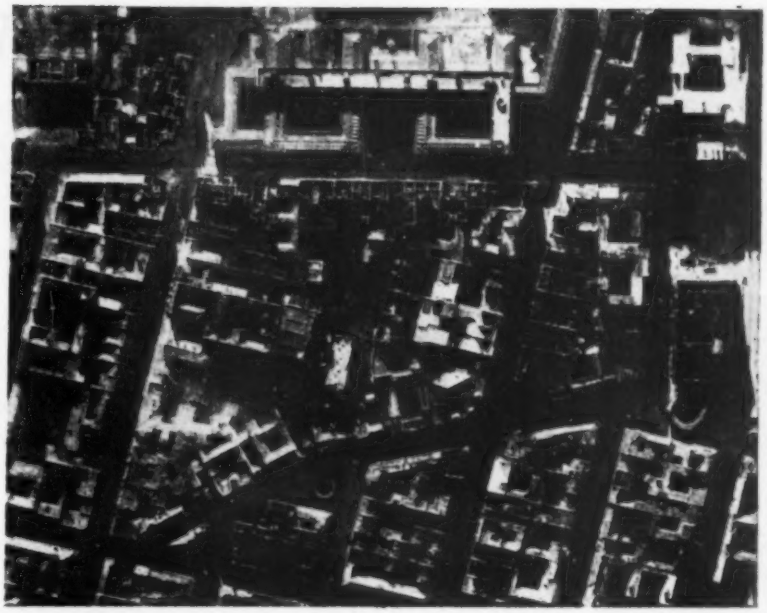
very good) and must run little risk except from *flak*. German *flak* is never to be despised, but the American day-bombers have found that the losses they suffer from it do not compare with their losses from *Luftwaffe* fighters.

Scrutiny of the photographs taken by reconnaissance aircraft from a height of some five miles above Berlin have shown that up to the night of February 15th no less than 326 war factories had been destroyed or damaged. These are of varying importance, and the degree of damage varies. The Ministry of Economic Warfare has made lists of factories in Germany, grading them in order of importance. Berlin contains, or contained, 103 factories of great importance, which is a greater number than any other city in the Reich can boast. Of these 44 had been hit up to the date mentioned, and 29 of them had suffered severe damage.

This report is now out of date. Other raids have fallen upon the German capital since those photographs were taken. On the night of March 24th-25th Bomber Command made its heaviest attack to date, when 2,500 tons of bombs were dropped. Two days before that the Americans had attacked the city in daylight, and perhaps it was as a result of their attack that the defences were strengthened. On that Friday night more than 1,000 British bombers were out over Germany, attacking Kiel and other places as well as Berlin. But the great battle took place over the Capital, where the defences were stronger than ever. In the night's work Bomber Command lost 73 aircraft, the second heaviest loss to date.

London had a noisy time on that same night, when some 100 German bombers attacked it, but the greater part of the noise was due to the guns of the defences. In this war, as in the last, there are some people who are more upset by the noise of the guns than they are by the sound of falling bombs. Perhaps they were not in London in the first days of the 1940 blitz, when there were very few guns to shoot at the hundreds of raiders. When a reasonable number of A.A. guns at last arrived, and one night they unexpectedly (to the general public) sent forth a really impressive roar, the delight of Londoners was great, and their *moral* (never much depressed) went up at once.

On the whole, German *moral* seems, from the accounts which have reached this country, to be not unduly shattered so far by the bombing. Several well-informed authorities have described the chief result of it as a general apathy. The German will to resist, at least among the civilian population, is likely to hold out until it is realised that their armies are defeated. Dr. Göbbels is therefore doing his ingenious best to prevent the people from realising how terribly the Russians have surged forward. The Germans can take comfort from Kesselring's defence in Italy—and the Anglo-American invasion has not yet happened. But it will come soon.



SUPERCOVENTRATED : Raid damage in the Berlin central area. The big building at the top is the German Air Ministry which fronts on to the Wilhelmstrasse.

BRITISH & U.S. AIR LOSSES TO MAR. 25th

	Over G.B. A'cft.	Continent B'brs.	Continent F'trs.	Middle East A'cft.	Italy A'cft.
Mar. 19	0	2	0	0	17
20	0	10	9	0	3
21	0	0	8	0	4
22	0	46	9	0	4
23	0	29	7	0	0
24	0	76	7	0	11
25	0	4	0	0	1
	0	167	40	0	40

Totals : West, 10,744 ; Middle East, about 2,387 ; N.W. Africa and Italy, 1,866.

WHAT A NIGHT ! Flt. Lt. J. Singleton, D.F.C. (centre, bandaged) and his navigator F/O. Haslam (right, also bandaged) back in the Mess after destroying three Ju 188s within 20 minutes. Their starboard engine caught fire and the port engine cut. They crash landed in the dark. After putting out the fire with earth they walked home two miles.

THE VICKERS WARWICK . . . .

Anglo-American Collaboration in New Air Transport Type : Original Wellington Figures Nearly Doubled

WHEN seen from a distance the new Vickers Warwick might easily be mistaken for a Wellington. It has the same shape of streamlined fuselage, surmounted at the back by a very tall fin, and the same tapered, high-aspect ratio wings projecting unusually far beyond the two engine nacelles. Closer inspection reveals, however, that the Warwick is a much larger aircraft than the famous Wellington. How much larger is best told by the comparable figures.

The original Wellington 1 had a length of about 64ft., a wing span of 86ft. 2in., a wing area of 750 sq. ft., and a normal loaded weight of 24,850 lb. The power plant consisted of two Bristol Pegasus XVIII engines giving 965 b.h.p. each for take-off and having an international rating of 780-815 b.h.p. in low supercharger gear at 4,750ft., and 720-750 b.h p. in high gear at 14,750ft. The original version of the Wellington had a maximum speed of 265 m.p.h.

For the Warwick the dimensional figures are: Length, 70ft. 6in.; wing span, 96ft. 8.5in.; height, 18ft. 6in.; wing area, 1,006 sq. ft. (gross); aspect ratio, 9.3. It is, however, in the loaded weight that the greatest step-up is found. This is 45,000 lb., a far greater percentage increase than the dimensions would lead one to expect. This is explained by the fact that the wing loading of the Warwick has been raised from the 29.6 lb./sq. ft. of the original Wellington 1 to 45 lb./sq. ft. No performance figures are available, but it may be expected that the take-off run and rate of climb are somewhat less good, in spite of the fact that the Warwick has much more powerful engines.

Two versions of the Pratt and Whitney R-2800 series are used in the Warwick: the S1A4-G and the 2SB-G. Both are 18-cylinder radial air-cooled engines, the former having a take-off power of 1,850 b.h.p. at 2,600 r.p.m. The latter is rated at 2,000 b.h.p., but no detailed performance figures have been released.

Taking the S1A4-G as a basis, the power loading at take-off is 12.16 lb./h.p., which compares with about 12.8 lb./h.p. for the Wellington 1. This relatively small decrease in power loading is scarcely likely to make up for the great increase in wing loading, but operational ideas and requirements have undergone considerable changes since the days of the early Wellington.

The Pratt and Whitney S1A4-G Double-Wasp has a two-speed blower, the normal power ratings being 1,500 b.h.p. at 2,400 r.p.m. at 7,500ft. in low gear, and 1,450 b.h.p. at the same engine speed at 13,000ft. in high gear.

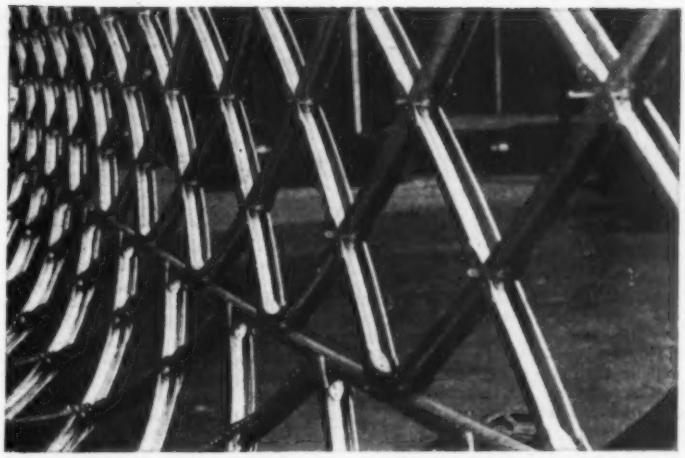
Descended from the Vickers Wellesley and Wellington, the Warwick is of geodetic construction, in which the structure is in the form of a wickerwork pattern of bracing members, each capable of taking both compression and

tension loads, and so interconnected that the compression loads in one member are relieved to a considerable extent by the tension loads in other members. Low structure weight is claimed to result, and it is a fact that in Mr. B. N. Wallis's designs wings of very high aspect ratio are used without undue increase in wing weight. This high aspect ratio reduces induced drag, and is thus extremely beneficial on long flights at economical cruising speed, and also during climb.

There is little doubt that it was the high-aspect-ratio wing which was largely responsible for enabling three Wellesleys, in November of 1938, to break the then existing world's distance record. Two of the three flew non-stop from Ismailia, Egypt, to Port Darwin, Australia, a distance of 7,162 miles. A third machine had to make a forced landing at Koepang, on the island of Timor, reaching Darwin later. But even this machine had broken the world's record, previously held by the Russians with a flight from Moscow to California.

Operationally the Warwick has already, like its famous predecessor the Wellington, seen service in many theatres of war. Its present function is air transport of passengers and freight, and it will be noted that in the picture it is shown with civil registration markings. The fact that no unsightly and drag-producing excrescences mar the excellent streamline shape is well brought out in the picture on the opposite page.

There is little doubt that in the months to come the Warwick will form an extremely useful addition to our flying strength. It is, perhaps, too much to expect that it will have as long a life and as varied functions as the Wellington, which as been used for almost every conceivable task, but we imagine that when the second front opens the Warwick will be doing some very useful hauling.



Geodetic construction is a feature which the new Vickers Warwick shares with its famous ancestors, the Wellesley and the Wellington.

Reward for Service

AS a token of appreciation for over forty years' service as its secretary, the Royal Aero Club last week presented a testimonial to the value of £8,500 to Lt. Cdr. Harold Perrin, who is to retire from office.

This handsome gift, subscribed by individual members of the R.Ae.C. and the aircraft industry, was presented to Cdr. Perrin at the club's annual general meeting by its re-elected president, Lord Brabazon.

In a speech which contained many humorous references to their secretary's well-known characteristics, Lord Brabazon said that Cdr. Perrin joined the club when they started as a group of "rather crazy balloonists," and it was as a balloonist that he came to them. He organised the first balloon races—races which had little or nothing to do with speed. "Then came the aeroplane," said Lord Brabazon, "and Perrin emerged as a great organiser." Mentioning the Gordon Bennett, the Schneider Trophy, King's Cup and the England-Australia races, he added that the bigger the event the better Perrin handled it. "Perrin has been the club," he concluded, "and it is going to be difficult to think of the R.Ae.C. without him. In fact, I'm not going to think of it without him, but trust that, in spite of his officially retiring, he will continue to look after us for some time to come." At a time when nobody was rich, he thought that the response in cash to the appeal for a testimonial showed what people thought of Harold Perrin.

In his reply Cdr. Perrin observed that "Brab" had described him as a bit of a dictator, but there were good and bad dictators, and the state of the club showed they hadn't anything to grumble about. (Laughter.) What was particularly gratifying to him was that more than 75 per cent. of the club's membership had subscribed to the testimonial, and these subscriptions had come from all over the world.

Cdr. Perrin reviewed the club's financial history, and said that they had Sir Frederick Handley Page very largely to thank for its healthy condition. Although its capital was still seventy-one shares of 1s. each, its reserve fund ran into five figures, and he caused more laughter when, referring to a windfall of £10,000 in deposits forfeited in connection with entries for the Schneider Trophy race, he mentioned that he had managed to get this declared not subject to income tax in spite of their own counsel's opinion to the contrary.

This, he concluded, was not a farewell party: "You haven't seen the last of me yet."

During the routine business of the meeting which preceded the presentation Lt. Col. Sir Francis K. McClean and Sir Frederick Handley Page were added to the list of vice-presidents, Lord Brabazon saying of the latter that time had diminished neither his energy nor his biblical quotations. (Laughter.) "But for Handley Page," added Lord Brabazon, "there might not be a Royal Aero Club." Of Sir Francis McClean he said that he had provided the club with the use of its first airfield, and it had been due to his generosity and in his own machine that the first naval officers in this country were taught to fly.

SIGNIFICANT MOVES IN U.S. CIVIL AVIATION

"A BLUE print for an 'all-American flag' airline, designed to operate round the world, was made public here in a Bill introduced into the Senate by Senator Patrick A. McCarran (Democrat, Nevada)," says a recent Reuter message from Washington.

This legislation, entitled the "New Civil Aeronautics Bill," is designed to put the U.S. well into the field of post-war air transport.

Senator McCarran proposes that the American Government charters a private corporation with a potential working capital of more than $1,000,000,000 (£250,000,000). This airline corporation would have active partners throughout the U.S. who would funnel international business into designated points of entry or departure. The corporation would be made up of domestic airline companies, but none of them would have a controlling interest in the corporation.

He told the Senate: "I am convinced that this Bill presents the soundest solution to our national problem of ensuring that the U.S. has its proper place in world aviation. We cannot afford to come out second best in the race for air commerce in the world's markets."

The Bill also calls for the establishment of a national airport in the U.S.

A few days later it was reported that two American air transport companies—American Airlines, Inc., and American Export Airlines, Inc.—had announced the signing of an agreement under which the former acquires control of the latter's air lines "in a move to develop international air transport under the American flag."

Mr. O. N. Kemp, President of American Airlines, said: "We believe the consummation of this transaction on receipt of Government approval will be of material help in solving international air problems of the U.S. and should ensure a strong position for our country in the air."

HERE AND THERE

Barrage Balloon Pioneer

MR. LEONARD BROWN, who directed the making of Britain's first barrage balloons for Dunlop, has died at the age of sixty-one, three years after retiring.

U.S. Flying Ambulances

MORE than 173,000 sick and wounded were evacuated from all operational war theatres by U.S. Army aircraft during 1943. They included Allied as well as U.S. personnel, and only eleven deaths occurred—a commendably low rate of 0.006 per cent.

Airscrew Blade Film

A COPY of the colour film dealing with the manufacture of Weybridge blades, to which we referred recently, will be loaned, free of charge, to technical institutes, manufacturers, and all concerned with the aircraft industry, on application to the Publicity Manager, The Airscrew Co., Ltd., Grosvenor Gardens House, Westminster, S.W.1. Alternative showing dates should be stated.

Salute the Soldier

LOUD-SPEAKERS remind us (via the office window) as we write that this is "Salute the Soldier" week, and while we and our readers are primarily interested in the R.A.F. and F.A.A., we must also be well aware by now of the overwhelming value of "combined operations" when it comes to smiting the Hun. In any case, the airborne troops are equally our concern.

Portuguese Venture

THE four principal shipping companies in Portugal, have joined with the airways company, *Aero Portuguese Limitada*, in an association designed to develop Portuguese airlines to the Colonies and Brazil. The project will shortly be submitted to the Government.

Dr. F. J. Viera Machada, Minister for the Colonies, has appointed a Commission to draw up a scheme for airfields in Sao Thome, Brazil.

Seniores Priores

A MOSQUITO flown by James Follett, a de Havilland test pilot, recently covered the 377 miles from Toronto to New York in 55 minutes, making a point-to-point average speed of 411 m.p.h.

This very fine performance is a concrete reinforcement of the de Havilland claim for the Mosquito as being "the fastest aircraft of its day." 411 m.p.h. can scarcely be looked upon as "economical cruising," nevertheless even if a 30 m.p.h. tail wind was present when the flight was made, 381 m.p.h. cannot be described as dawdling.

World's Largest Airscrew?

A THREE-BLADED airscrew measuring 20ft. in diameter, believed to be the world's biggest, has been built for experimental purposes by Hamilton Standard at their East Hartford plant, U.S.

Two vital factors, namely, tip speed and centrifugal loading on the blade roots, limit the practical increase of airscrew diameter, and experts in this country have expressed the opinion that optimum power-absorption would be reached by an eight-bladed contra-prop of about 22ft. diameter.

Turbine-driven Airscrews

STRESSING the fact that too much emphasis has been placed on jet propulsion, Mr. G. Geoffrey Smith, managing editor of *Flight*, pointed out in his most recent broadcast talk last Tuesday that a likely future development is the adoption of small-diameter contra-rotating airscrews driven by the turbine shaft, and that only the surplus gas from the turbine will be used for direct jet propulsion.

Thus, he added, the gas turbine perfected by Group Captain Whittle might challenge the supremacy of the orthodox reciprocating engine rather than its airscrew.

Australian Air Plan

THE Australian Government is considering a post-war air plan to bring any place in Australia within 24 hours of any other.

The plan would provide for 22 centres linked by trunk lines, each centre to be served by smaller air lines.

Senator D. Cameron, Commonwealth Minister for Aircraft Production, announced that after the war Australia would build a fleet of passenger transport aircraft, as she could not risk essential air services being controlled by conflicting authorities.

The Government's policy was to make Australia as independent as possible, he added.

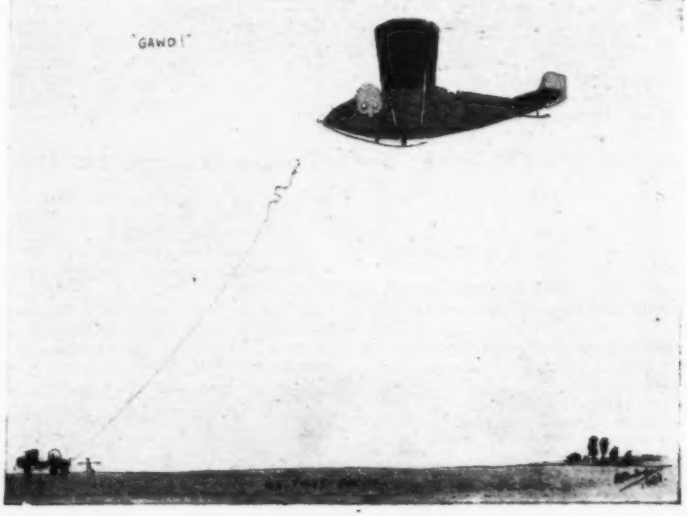
SPRING FASHION: The latest R.C.A.F. two-piece flying suit, known as the "Type E," avoids bulkiness by judicious zipping, and can be shed in 15 sec.

Anything But!

TRUSTING—perhaps inadvisedly—to our memory, it was during the 1914-1918 war that the New Zealanders popularised the use of a special term for the non-flying Air Force officer; they called him a Kiwi, which is the "national" bird of New Zealand that does not fly. To be brutally frank, the word was generally reserved for those who were suspected of being young and fit enough to fly but preferred a softer life on the ground, and thus the term acquired an anything but complimentary significance in those days.

So it seemed passing strange that the New Zealand Official Press Department should, in sending out an account of the flying accomplishments of the R.N.Z.A.F., head it with the phrase, "Kiwi Airmen in Pacific."

Evidently the Kiwi is so firmly estab-



HERE AND THERE

lished as New Zealand's national emblem (like the Kangaroo in Australia) that those earthbound qualities which make it so unsuitable for linking with the gallant R.N.Z.A.F. have been forgotten.

Come to think of it, even the Kangaroo accomplishes prodigious hops!

New Cellon Directors

MESSRS. H. Lazell and W. J. Shilcock, who have been actively associated with Cellon, Ltd., since its formation, and on the board for over fifteen years, have taken over the duties of joint managing directors since the death of Mr. Wallace Barr, who was killed in a recent air raid.

It is also announced that Mr. J. Duncan Ferguson, F.C.A., who has been closely connected with all the company's activities for a number of years, has been co-opted a director and has accepted the invitation of the board to occupy the office of chairman.

Trunk Route Control

MR. JOHN CURTIN, the Australian Prime Minister, commenting upon the reported decision by Canada to support Australia and New Zealand's advocacy of post-war international control of aerial trunk routes, said recently: "I have had discussions during the week-end with Lord Knollys, chairman of British Overseas Airways.

"I notice increasing adhesion to the point in the New Zealand agreement that aerial trunk lines should be internationally controlled."

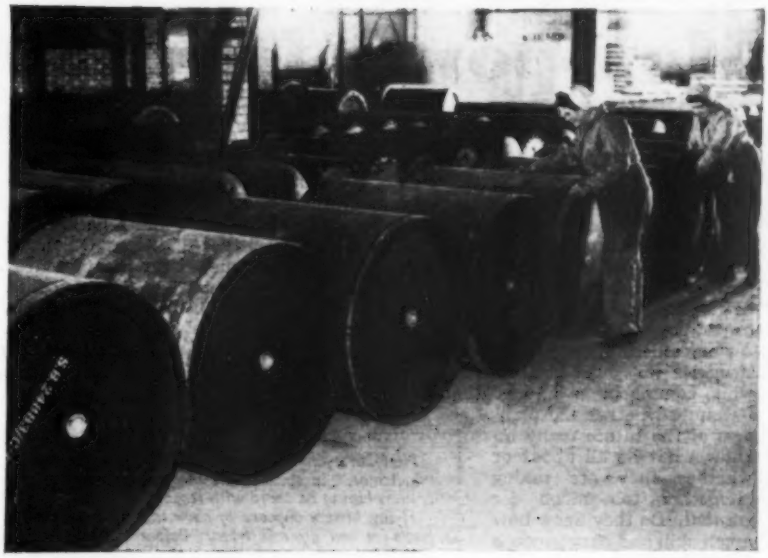
It was unofficially stated that the Commonwealth has reason to believe that the Dominions are generally favourable to the Australian-New Zealand proposition.

Nipping the "Nips"

AIR MARSHAL SIR KEITH RODNEY PARK, A.O.C.-IN-C., Middle East, recently said: "After the war with Germany the Middle East will be the hub of a vast trunk air route, along which hundreds of squadrons from European theatres with auxiliary units will flow to the Eastern front."

Sir Keith, who was addressing correspondents for the first time after taking up his new command, added that the new route would cross Europe on its way to Africa via the Middle East, on its way to the Persian Gulf. Squadrons were now operating from the Persian Gulf south, all along the east coast of Africa, fighting long-range Japanese submarines.

The presence of aircraft had forced the Japanese to abandon the use of submarine supply ships in the Indian Ocean.



THREE-IN-ONE: A corner of a store of 4,000lb. bomb sections, three of which go to build up the 12,000lb. factory busters now being used by Bomber Command to squash the German war industry. Women are employed in their preparation, but the sections shown here are empty.

We Regret

CLAIMING to have given its readers "more technical information about jet propulsion than they can get, even now, from any other source," the February issue of *Canadian Aviation* takes credit for having, in its issue of November last, "presented most of the scientific facts underlying jet propulsion that have since been published elsewhere."

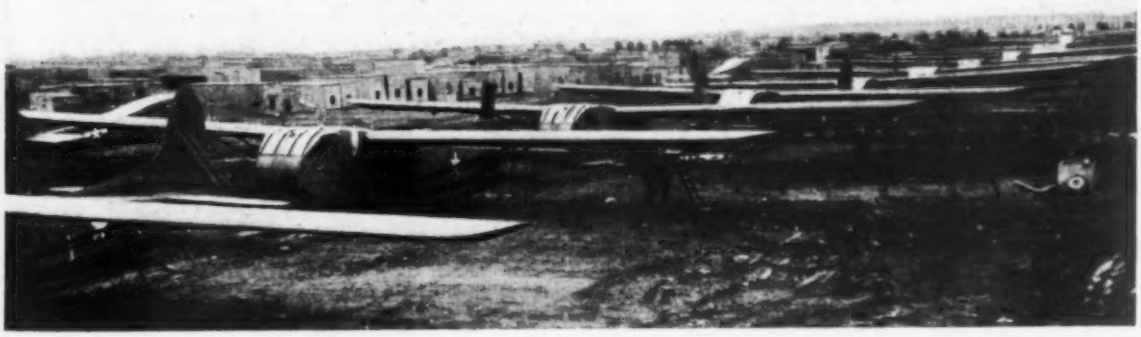
The reference is to an article in its November issue signed by Paul James, and, skipping the fact that it requoted some of the technical information on the subject given months previously in *Flight* articles by Mr. Geoffrey Smith, and was actually illustrated by two *Flight* drawings, the "scientific facts" given by its author included the statement that "if we let them (the expanding gases) act directly *against the atmosphere* back of the plane, we get a propulsive effect——"

The italics are ours, but few *Flight* readers will need to have them interpreted!

But what is even more reprehensible is that, reviewing the January news release on the jet-propulsion story, *Canadian Aviation* deliberately ignores the inventor, Group Capt. F. Whittle, R.A.F., and the pioneering work done by Power Jets, Ltd., and B.T.H. It merely says, "The engines were designed in Great Britain, and built secretly in the U.S. by the General Electric Coy., the plane being built by Bell Aircraft."

U.S. Commander Promoted

BRIG. GEN. HUGH J. KNERR, Deputy Commander for Administration and Commanding General of Air Service Command, U.S. Strategic Air Forces in Europe, has been promoted Major General.



HADRIAN HUTMENTS: Camp buildings ranging from post-office to mess hall on this U.S. Ninth Air Force Service Command station are built from the packing cases in which Waco CG-4A troop-carrying gliders arrive from America. After assembly the Hadrians (as they are called in the R.A.F.) are towed away to their operational bases elsewhere.

D

Indicator Discusses Topics of the Day

Man-power for the Mammoths

Are We Trying to Run Before We Can Walk?: In Criticism of Hundred-ton Projects : Choosing the Crews : The Human Element

WHENEVER I see pictures or descriptions of some projected aerial giant of the future, I am filled with vague forebodings. Not only do I feel that the whole thing is being allowed to get out of hand, and that, consequently, the designer boys must on no account be given their head, but I wonder what sort of man is going to be allowed to drive the outfit when it has been made.

Remembering the many wet and nervously exhausting struggles we've all had with biggish present-day aircraft while coming in to land in difficult or bumpy conditions, I wonder whether the planners of the future really *do* know what its all about or whether they are taking altogether too much for granted. Do they know how much skill and experience is needed to bring a modern machine down safely in a cross wind and when rain or snow or bad visibility are making things increasingly difficult? Do they realise quite how much the safety of the passengers still depends on this skill and experience—and even more on the mental and emotional make-up of the pilot? Do they really understand that an aircraft, whether big or small, and however well appointed with bed-sitting-rooms and cocktail bars, is still something that can stall in, or swing stupidly and uncontrollably after a badly executed cross-wind landing. Do they remember that, except for a certain increased steadiness due to size and wing-area, there is no essential difference between a Spitfire and a six-engined commercial aircraft weighing a hundred tons or so?

I don't really think they do, and I don't think they realise that everything, in the end, depends on one man—and that one man cannot stop and think, or drop anchor, or ask for the assistance of tugs or of a pilot who knows the layout of the terminal airfield. There it is, a hundred tons of assorted and not very robust ironmongery, cleaving the sky at a minimum speed of 140 m.p.h., and actually making contact with the runway (perhaps not square into wind) at 100 m.p.h. odd. And it is still only an enlarged Spitfire with a higher landing speed and, maybe, considerably less pleasant characteristics. Tricycles—or whatever the ultimate development may be of the c.g.-forward level-landing gear—will simplify the touch-down and remove the possibility of swinging, either on take-off or landing, but the approach must still be made with accuracy and the end of the runway (not the next field or the brace of hangars in the corner) must still be hit accurately and at the right angle in any sort of weather.

Temperamental Baskets

Surely we must learn to walk before we can run, and surely we cannot afford to put all our eggs in a few large baskets when the baskets are still such slender and temperamental things? Let us spend the first ten years of the peace developing new and better means of flying with safety, while using aircraft of reasonable size on the air services, before we even start to think about hundred-ton giants filled with over-confident people. When we've flown a series of airlines for a year without a single accident which can reasonably be put down to aerodynamic vice or human error—then we can start thinking big. At present it is just crazy to imagine that we can go on increasing weight and size and wing-loading without a continuous series of major catastrophes as the crews, keen on showing the usefulness and reliability of air transport, attempt to cope with conditions which are, and will always be, a little too much for the present-day conception of an aircraft.

Supposing that the planners get their own way and that the giants are put into service, who shall we choose to take major charge of them in the air? The youngish, experienced commander who may have dash enough to attempt the too-difficult once too often, but who is not easily tired or beaten by circumstances, and who has the good eyesight and quick reactions of the medium-young man who has lived a vigorous and healthy life?, or the more elderly type of man, still hale and hearty like the captains of ships, who knows caution, who has travelled tens of thousands of hours in the air, and yet who may not have that final nicety of judgment and confident dash of the fairly young man?

NOT everyone will share the views here expressed by "Indicator," in spite of his long experience as a pilot, which entitles him to be heard with respect.

Flying history appears to show that we have always found the pilots for new aircraft types. Before this war one might have doubted that youthful pilots could be taught in a few months to fly our heavy bombers to Berlin and back through bad weather, heavy flak and fighter opposition.

We are not likely to have thousands of "hundred-tonners" flying about on civil work, and the comparatively few pilots required can surely be hand-picked from among the large numbers of experienced men who will be available by the time these giants go into regular service.

I have known airline pilots with ten thousand hours to their credit in various types who were, in my own perhaps inexperienced opinion, lacking in true airmanship and quite lacking in the ability to deal with strange situations in new types. Men who brought aircraft in with a shaky series of throttle-bursts to an appalling landing, and men who, in over-caution, have brought them in at ridiculously high approach speeds while motoring, in fear of over-shooting at tree-top height, and have then floated all the way down the runway. On the other hand, I have known young men, with comparatively few hours to their credit, who have handled big four-engined aircraft for the first time with a fine admixture of caution and confidence, and who have not been put out or flustered by the most unpleasant situations. And, of course, I have known experienced pilots who behaved just as one would expect them to behave, and inexperienced pilots who have been over-confident and yet nervy.

Critical Passengers

Thousands of the passengers of the future will be men and women who know what it is all about and who will not be taken in by examples of bad judgment; who will not, in fact, allow themselves to be flown twice by any pilot who has put up a bad exhibition. The passengers are going to be critical and even frightened in the future unless the very best hand-picked pilots are used. And how are they going to be picked? They *can*, in the end, only be picked by other pilots, though a bunch of really good psychiatrists should be able to whittle down the original entry. The nervy or slow-thinking or unintelligent type of man can usually be picked out quite easily on the ground, but there are people who can show none of these qualities until they are faced with real difficulties and dangers, and there are others who would not pass a board of "experts," but who would come out very well when faced with a real emergency.

Of course, the projected giants will have a large crew, every possible aid to navigation, both general and detailed, and, maybe, automatic approach devices, but we still know that, until design has been radically changed, one man is, when it comes to the point, vested with the power of life and death with an aircraft of any size and type. One single person is in charge during and immediately after the take-

MAN POWER FOR MAMMOTHS

off, and one single person is in charge during the approach. On his handling of the throttles, brakes and rudder, on his quick decisions while briefly scanning the boost gauges and revolution counters, and on his behaviour immediately after the aircraft has left the ground, depends the safety of the whole outfit; on his judgment of height and distance, or his ability to correlate instrument readings and aural signals during a blind, or semi-blind approach, depends the whole future of flying, as well as of the passengers.

He must be an absolute master at the game. There are a few of them, all of different ages; no age-limit can be set except in so far as sheer age affects fitness. No amount of training can make them. Though training can make the bad into mediocre, and the mediocre into good and can even produce a pilot who is capable, in a series of well-organised reflexes, of doing everything very well in the normal conditions, it cannot make the effortlessly good pilot or the leader of men. He is just born that way, with an undisturbed nervous system (or, at least, one that is, however disturbed, not liable to affect the clarity of the thinking processes), quick, but not too quick reactions, and a reasonable degree of sheer fatalism and/or belief in himself.

No rules can be laid down. The airline pilot of the future will be picked by common consent, and by other pilots who fly with him. There is nothing of the "superman" nonsense about it all. He will simply be the sort of man who would always get along well in the world of real facts, rather than the somewhat airy individual who had, at least until the start of this war, tended to be in the majority of those who took up flying as a profession. That haphazard type killed a lot of people with the best intentions in the world. And he is now as dead as a door-nail himself. A new generation is here. INDICATOR.

WITH THE PARATROOPS

As the invasion date approaches, the training of all arms reaches its zenith. Doubtless a heavy responsibility will fall on the paratroops during the early stages of the re-entry into the Continent. (Top left) Briefing in the operations room with the aid of a relief map of the area to be attacked. (Top right) When a Whitley is employed as a paratrooper the bomb aimer operates the jumping lights. A "Red" is given to indicate "Action Stations" and "Green" for the actual jumping. (Right) Douglas Dakotas are also extensively employed as paratroopers. The static lines which open the parachute and remain with the aircraft can be seen in front of each man.

Wrens of the A

7. Over to you. An R/T operator "working" flying trainee telegraphist air gunners.

11. A radio mechanic takes out a radio set to be installed and flight-tested.
12. Typical scene in the room where parachutes are hung and repacked.

Girls of the Fleet Air Arm Take Over More Duties : All Ground Maintenance Within Their Scope

THE employment of the women's auxiliary services by the Navy, Army and Air Force has had three distinct phases. In the beginning they were not taken seriously but were treated very politely and allowed to "play around." The second phase saw them accepted for all the menial housework sort of jobs but considered a nuisance when they took on what had hitherto been masculine preserves. Finally they were accepted for what they are—extremely efficient and painstaking workpeople and a decoration to any camp withal. The Wrens in the Air Branch of the Royal Navy are no exception to the rule, and they are doing a good job of work at the shore stations of the Fleet Air Arm.

The photographs which accompany this article were taken during a visit to H.M.S. *Kestrel* (alias Worthy Down), where telegraphist air gunners are turned out in quantity. They present a true picture of the women who are keeping the training aircraft airworthy and running the ancillary services without which the school could not function.

In all there are 34 categories (the Royal Navy does not have trades) of Wrens at H.M.S. *Kestrel*, but only ten have direct contact with aircraft. Of these the air mechanics are of major importance and are classified as A (airframes), E (engines), L (electrical), and O (ordnance). In like manner to their masculine counterparts they take the responsibility of signing-out their part of the aircraft as airworthy. Before being posted to stations the air mechanics have had an intensive training, which varies from 17 weeks for the ordnance fitters to 24 weeks for the

Air Branch

1 to 4. Wren air mechanics (engine) working on 205 h.p. De Havilland Gipsy Queens in Percival Proctors and on a 580 h.p. inverted vee Ranger in a Seamew.

5 and 6. On the "Snag Patch." Wren radio mechanics eliminating faults on a Westland Lysander and a Proctor.

8 and 9. Wren meteorologists about to ascertain the speed of the upper winds with balloon and theodolite and taking readings of the wet and dry-bulb thermometers.

10. Drawing a synoptic weather chart from coded information received over the teleprinter.

13. Off duty. At the end of the day's work the Wrens cycle off to their quarters, which are some miles from the airfield

WRENS OF THE AIR BRANCH

electrical mechanics. The airframe and engine mechanics both have a training course of 18 weeks.

Dealing with the taking on charge of aircraft is a category known as an aircraft checker. Her job is to check a machine as it arrives from the store, or from the manufacturer, to ensure that the inventory is complete. This is no sinecure. One machine, for instance, has an inventory of over 1,000 items and these are expected to be checked in about an hour.

Radio mechanics have the longest period of training before posting. They get 18 weeks at a polytechnic and a further three months in *H.M.S. Ariel*. Because of the intensity and nature of the training, all the trainees are given seven days' mid-term leave. On the station they maintain, install and repair all the radio, and this includes air-to-ground tests. Flying for these tests is not compulsory but it is encouraged. One of the girls to whom we spoke said that she had made as many as seven half-hour flights in one day. Out by the runway there is a small area known as the "snag patch." Here any of the training aircraft in trouble with their radio can taxy up and receive immediate attention. Sometimes the bother is only the misuse of coils, but at other times the snag is so obscure that it means a careful check of all the circuits.

The ground W/T and R/T stations are also run by Wren operators. Each operator works five training aircraft, taking each one in turn for 15 minutes. The four aircraft not in communication pair off and practise air-to-air messages between themselves. The girls are not classed as instructors, but they do put the embryo T.A.G.s right in the matter of signal procedure.

With the exception of one F.A.A. officer, the whole staff of the met. office are Wrens. The girl ratings do everything except the actual forecasting, which is the preserve of commissioned ranks. The work includes the reading of all the meteorological instruments, measuring the speed of the upper winds, decoding the observations received over the teleprinter, and drawing synoptic charts. Here again the authorities encourage the girls to fly and to see the weather from the airman's point of view but, of course, there is no suggestion of compulsion.

Apart from telephony and telegraphy, the other main subject of the school is air gunnery. This is carried out from against towed sleeve targets. The guns are serviced and installed by the Wrens and the checking of the hits on the targets is also done by them.

As would be expected, the folding and repacking of the silk parachutes is well done by the sympathetic hands of the Wrens, and their efficiency is such that this heavy responsibility lies but lightly on their shoulders.

So it is throughout the whole camp. Men and women are accepted as equals, and an air of cheerful comradeship is apparent. At the end of a busy day the girls move off the station to their billets—known colloquially as "Wreneries"—some of which are several miles away. Each girl has either a bicycle issued to her or motor transport is provided to carry her to and from duty.

WHAT RESEARCH HAS ACCOMPLISHED

SPEAKING to the Chamber of Commerce of Cleveland, Ohio, on March 21st, Mr. John F. Victory, secretary of the American National Advisory Committee for Aeronautics, outlined some of the developments, due to research, which had made possible an increase of approximately 100 per cent. in aircraft speed in the past ten years. In the main this increase in speed had been due to increased engine power without corresponding increase in weight; to aerodynamic refinements (external and internal); and to the development of improved airscrews.

Of the new N.A.C.A. low-drag wing shape now coming into general use Mr. Victory said that it reduces wing drag as much as all previous research had accomplished since the original Wright machine first flew in 1903.

Referring to the new Aircraft Engine Research Laboratory at Cleveland, authorised by Congress in 1940, Mr. Victory said that it was almost ready with a new development which would permit the operation of aircraft with a material saving in petrol. This would be very valuable "when we get around to the bombing of Japan."

Mr. Victory uttered a warning about Germany. She was capable of repeating in reverse the history of the Battle of Britain. "There never has been," he said, "an offensive devised by military science for which a defence could not be devised. Germany has the intelligence and the facilities—and the desperate needs. If the tables were reversed, and we were taking the pounding from the air that Germany is now receiving, we think we know what we would do to stop it. We cannot expect Germany to do less, provided we allow her the necessary time. The present relentless pounding of Germany from the air is aimed at knocking Germany out of the war before she has time to develop a defence adequate to bring the air war to a stalemate."

RUBBER-METAL BONDED COMPONENTS

AN interesting brochure, called "Elastomeric Engineering," has just been produced by the T. B. Andre Rubber Co., Ltd. "Elastomeric" is derived from the generic term elastomer, which relates to natural or synthetic substances having properties similar to rubber; thus elastomeric engineering is that branch of the industry dealing with the application of rubber-like substances.

The brochure deals with rubber-bonded-to-metal applications, and the technical data included are especially representative of the extremely wide range of uses to which these media can be applied. Broadly, the components can be classified into the following groups: (i) Anti-vibration mountings, (ii) Flexible couplings, (iii) Shock and sound absorbers, (iv) Gas and fluid seals, and (v) Protective coverings. As a single illustration, flexible (plate) couplings can now be produced with a non-thermoplastic bond between rubber and metal of some 1,000 lb./sq. in. capable of transmitting 1,500 h.p. at 3,000 r.p.m.; and also couplings (concentric sleeve) which can transmit a torque of 2,837 ft. lb. and provide a deflection of 237 deg. with a rubber of 35-40 deg. hardness (Shore). Engineers should find this booklet of more than passing interest.

CANADA'S AIR POLICY

MR. D. C. COLEMAN, chairman and president of the Canadian Pacific Railway, has issued in Montreal a statement with reference to that made by Mr. C. D. Howe, Minister of Munitions and Supply, in the House of Commons at Ottawa. Mr. Howe said that it had been decided that Canadian railways shall not exercise any monopoly of air services, and that steps will be taken to require the railways to divest themselves of ownership in air lines.

Mr. Coleman said: "This involves a radical departure from policies hitherto followed in Canada. The situation here is not parallel with that existing in any other country.

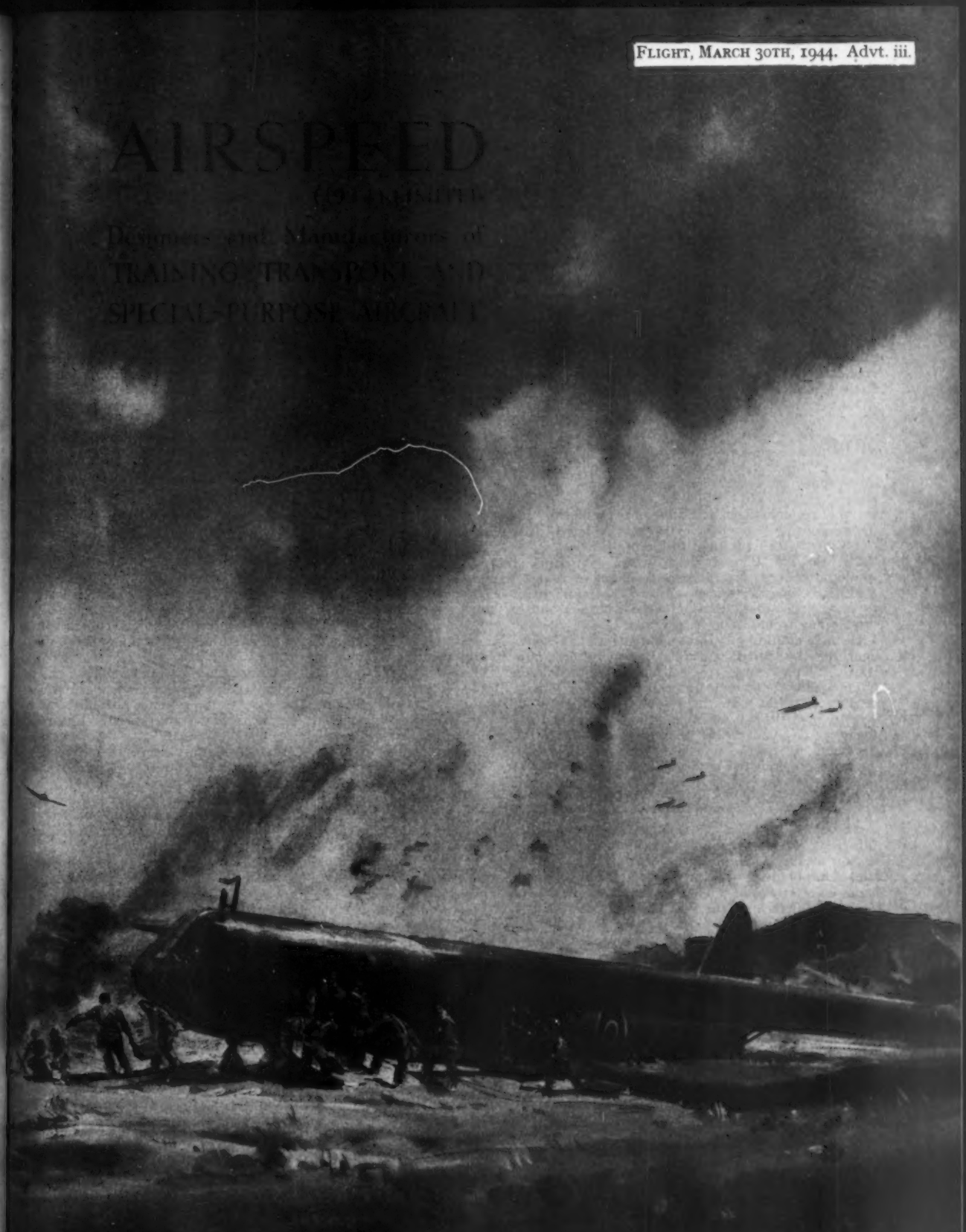
"In Canada both railway companies conduct transportation systems in the fullest sense, operating railways, steamships, telegraphs, air lines, express services, buses and trucks."

After stressing C.P.A.'s war service, he added: "Presumably legislation will be introduced to implement the statement of policy just made, and in the discussion and consideration of that legislation any experience or information which the Canadian Pacific Air Lines has acquired in the course of its operations will be made available if required."

TUNISIAN VICTORY

TUNISIAN VICTORY is the title given to the documentary film which has been produced conjointly by the British and United States authorities. The film is a most worthy successor to *Desert Victory*, which portrayed the Eighth Army's magnificent westward drive. The sequence of events is handled admirably simply, and although towards the final phases the developments are a trifle disjointed—or appear to be—on the whole, the tale is told with excellent clarity. The camera work is particularly impressive and brings home, as no other medium could, the appalling conditions which had to be borne, and the magnificent work done by everyone.

A most interesting glimpse is given of the airport at Gibraltar where an extensive "apron" for take-offs and landings has been pushed out to sea. This must materially reduce the limitations of flying at Gib. Other interesting air shots in this film are of Hurricane "tin openers" in action, and Lightnings doing a spot of skip-bombing. There are also some excellent reproductions of air-to-air combat gunnery and air-to-ground "tin-opening" taken by the automatic ciné cameras fitted to these aircraft.



In his sixth sketch, Frank Wootton visualises the disembarkation of airborne troops immediately a HORSA has come to rest in hostile territory.

AIRSPEED

ABILITY to discharge the load in the shortest possible time and without any outside assistance is a life or death matter in a war transport. Experience in catering to this need in the HORSA, standard towed transport of British airborne forces, will have its effect on Airspeed commercial transports in which the same facility may spell the difference between profit and loss

The Flying Boat

A Reply to Mr. Pollitt : Loading Freight Not Difficult with Proper Equipment : The Question of Lateral Stability

By W. P. KEMP

IN the issue of *Flight* of February 24th, Mr. Pollitt continues his argument in favour of the landplane for post-war civil aviation, and asks the question: "Will the Flying Boat Survive?" It most assuredly will survive but, of course, so will the large civil land machine. Each will have its own sphere, but the boat has many advantages in particular cases.

Mr. Pollitt states that "the past four years of Service aviation have indeed produced illuminating evidence of the total inadequacy of the flying boat as a load-carrying medium," and that "Coastal Command" employ only three types of flying boats against nine types of landplanes." I would venture to say that had it not been for the parsimonious attitude and vacillating policy of the responsible Government authorities in the two pre-war years, which resulted in infinitesimal orders for flying boats, the situation, as regards the submarine warfare, would have been very different. Had there been hundreds instead of tens of Sunderlands available for patrol work, there is little doubt that hundreds of thousands of tons of shipping would have been saved.

He then continues with the statement that "only 25 per cent. of the British Overseas Airways fleet are flying boats." This is surely due to war conditions having made it impossible for British firms to develop or build suitable civilian aircraft, with the result that they had to draw largely on American machines, there being no British passenger boats available for them. This condition is, unfortunately, likely to continue for some time unless the industry is permitted to develop suitable water-borne aircraft in time for the needs of the operating companies.

Forced Landings

The question of forced landings is raised, and the flotation bags for land machines are cited as a good example of how a land machine can be kept afloat. This argument was suitably dealt with in the editorial comment in the same issue of *Flight*. There is no doubt that a boat has a greater chance of survival on the water than has the land machine, and even if it were to break up, quite obviously similar arrangements of air bags could be used to keep it afloat. He says in this connection that the "Deutsche Luft Hansa were operating Dornier 'Wal' flying boats on the South Atlantic service between Bathurst and Natal, and during a period of two or three years it was only necessary to make three forced landings at sea." This is given by him as an answer to my suggestion that flying boats are safer for transoceanic work than the land machine. The mere fact that three safe forced landings *were* made reinforces the argument for the flying boat, as the future of civil aviation depends on its safety. What would have been the impression created in the public mind had these three machines been landplanes? One can well imagine the pre-war Press splashing headlines of "Another Transatlantic Air-liner Lost."

Freight Loading

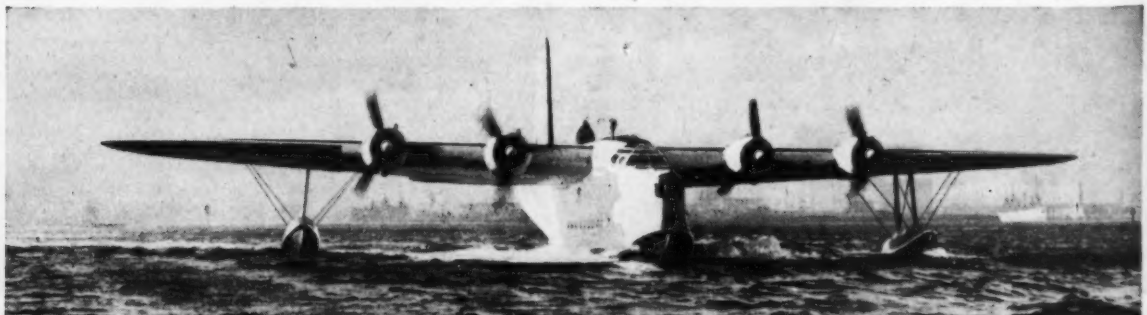
Emphasis is laid in Mr. Pollitt's article on the difficulty of loading freight into a flying boat, and this point was illustrated by a sketch showing what purported to be a floating crane loading a crate into a hatch in the hull, about 25ft. behind the c.g.!

Properly designed cranes moored in the correct manner, so that the flying boat and crane pontoon always remain in the same relative position one to the other, should not present any difficulty. One must be a water-man with plenty of experience of small craft to appreciate how simple such an operation would be.

On the question of lateral stability Mr. Pollitt argues that, because the undercarriage of the land machine is three or four times as wide as the planing bottom of the hull of the boat it is much more stable. Here, I think, he makes his greatest mistake, as he says, with regard to wing-tip floats, "that these only serve their purpose (as stabilisers) when the boat is at rest"—if this were so, wing-tip floats would obviously be made in the most efficient aerodynamical form, whereas, as everyone knows, they are designed largely for hydrodynamical efficiency; in fact, their planing bottom is, in general, of the same form as the bottom of the main boat hull.

One of the illustrations indicates my point—this shows a wing-tip float acting as a stabiliser while the boat is under way.

I have at times watched with considerable trepidation large land machines landing on a concrete strip in a cross-wind, and my heart has been in my mouth as one wheel gradually rose in the air while the opposite wing tip got nearer and nearer the ground, until the pilot could get sufficient control to bring it back to level again. Generally speaking, such conditions would not occur with the



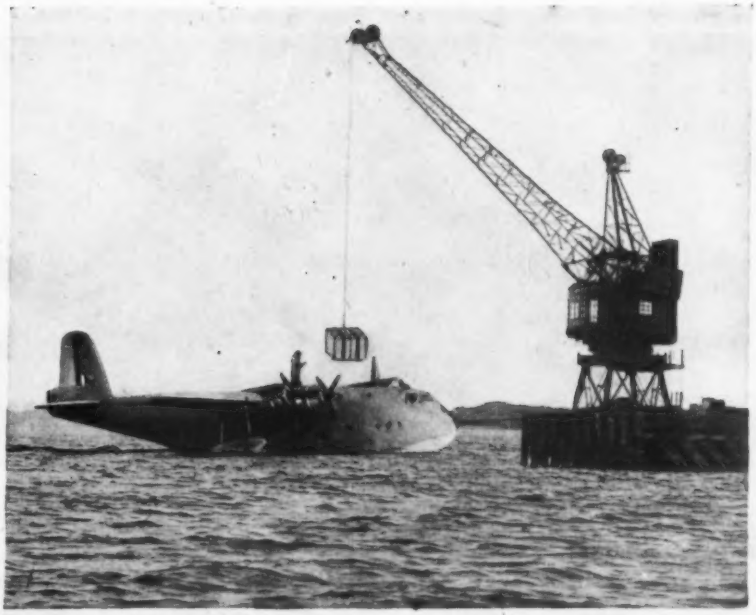
This photograph of a Short Sunderland shows the effective width of the "undercarriage" as measured between the wing-tip floats.

boat, as it can more often alight into wind; and in any case the levelling force of the wing-tip floats comes effectively into action just as the effectiveness of the aileron is decreasing due to loss of speed. Furthermore, there is no more likelihood of the failure of a wing-tip float chassis than there is of the undercarriage of a land machine, and, as the track of the wing-tip floats is at least twice that of the land machine chassis, it is clear that the lateral stability of the boat at take-off and landing conditions is much better than that of the corresponding land machine.

Great stress has been laid on the alleged fact that the flying boat may be 3 per cent. or so less efficient than the corresponding land machine, but does this really matter so much after all? It is generally agreed that in the very large sizes, for long-range trans-oceanic travel, this difference may disappear altogether, but the land machine has a slight advantage in the 30,000 to 60,000 lb. class.

The last ounce of efficiency is not the deciding factor—it is convenience and universal adaptability which will weigh the scales in the end.

In pre-war days many steamers only operated for three or four months in the year carrying holiday traffic. That was not efficient, but, nevertheless, the owners found that it paid them well to run for only one-third of the year and lay up for the other two-thirds. Similar arrangements are in vogue in some of the great African rivers where river craft, which have been transported in sections from this country to stretches of river above rapids, and reassembled there, are only able to operate for three or four months in the year, due to there being insufficient depth in long, continuous stretches of the rivers, in the dry seasons. Even under these conditions, there are frequent lagoons here and there with enough water from which flying boats, which do not require very great depths of water, could operate satisfactorily.



"Loading should be done by properly designed cranes moored in the correct manner."

Our ancestors overcame every obstacle of fever and antagonistic natives in exploring and opening up trade in out-of-the-way corners of the world. They operated by canoes, and eventually initiated small trading posts. Then followed the small river steamers which had to work the rivers by navigable sections with intermediate overland stages till, eventually, the native goods reached the seaboard and shipping companies found it paid them to make regular calls for freight. Let it not be said that the heritage of our race, the pioneering spirit, is dead. Undoubtedly there are still obstacles to be overcome, but they are not insurmountable, and their difficulty is greatly decreased by having at hand such a versatile and efficient vehicle as the flying boat.

FILMING NIGHT BOMBING RAIDS

MOVIE audiences throughout the Allied countries are being thrilled by pictures taken of night bombing raids by R.A.F. film cameramen working with an R.A.A.F. Squadron.

"Q for Queenie," piloted by Flt. Lt. W. Marshall, of Sydney, carries two R.A.F. cameramen, with their gear, and they film burning targets below them as the Lancaster flies on its bombing run.

P/O. John Morris, of London, and W/O. "Chick" McNaughton, of Dundee, Scotland, filmed the raid on Schweinfurt. It was while returning from that raid that "Q for Queenie" was coned by searchlights and then boxed by flak. Flt. Lt. Marshall threw the Lancaster about in desperate attempts to escape the well-directed fire of the German gunners. By the time he had succeeded, the Lancaster had fifty-seven holes in her mainplane, tailplane, fuselage, and pilot's windscreen, but nobody was injured. The films went on the news-reels.

P/O. Morris, of the R.A.F. Film Unit (Operational Section), explained the technique used in taking these films.

"We use standard-size 35-millimetre cameras, and we drop no flashes or flares. We rely on the light from the fires below, and the flares and photoflashes dropped from other aircraft," he said. "The front camera starts working as soon as we can see the fires burning in the city. As we get nearer, the cameraman points his camera to the spot where the nearest bombs are falling. Then our turn comes to make a run over the target and bomb. The cameraman in the middle of the aircraft starts his camera going as soon as he hears the order 'Bomb doors open.' He keeps on filming long after the message 'Bombs dropped' has been heard. In that way we get pictures of our own bombs falling. We follow them with our cameras right down until they hit the ground."

ROCKET OR RACKET?

THE ripples raised by the rocket-gun rumours continue to travel around the world. Here is the latest from Switzerland via America:

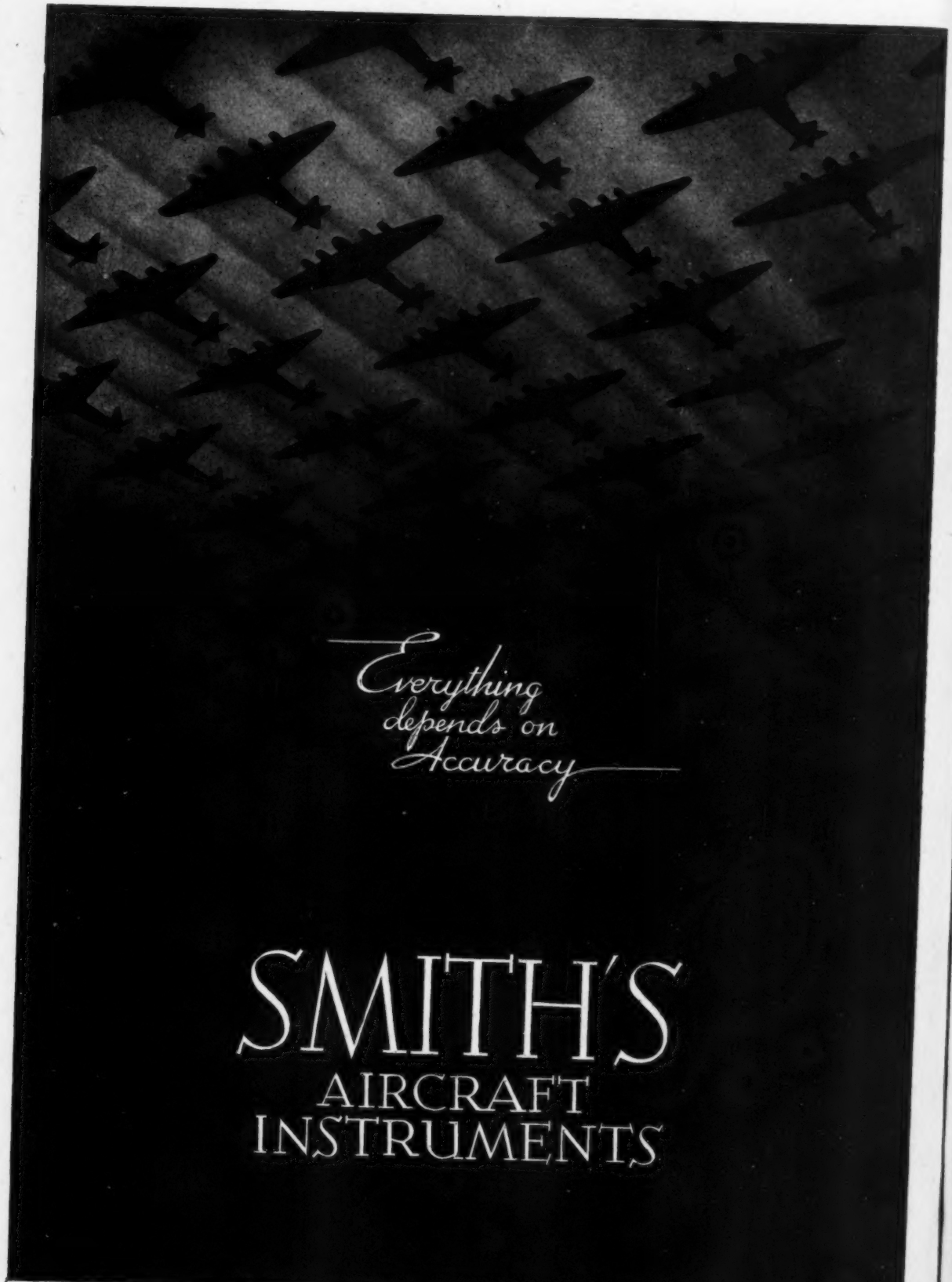
"From Switzerland last week came some fancy rocket talk," says a recent issue of the American journal *Time*. "According to this tale, the Nazis' secret weapon is a huge gun which fires massive air bombs (about 40ft. long, 4ft. thick), each one twice the length and thickness of a submarine's torpedo. Five or seven rocket installations in the tail keep the projectile going, outer rockets firing in pairs after a large central one has burned out. It is guided to its target by radio, and causes a tremendous explosion when it hits. The rocket gun even has a name—Urania.

"'Scare stuff!' snorted Dr. Alfred Stettbacher, a Swiss explosives expert. 'No rocket could be fired 120 miles to-day (shortest distance to London from the Continent: 90 miles); the rockets the Germans are using from aircraft against Allied bombers are actually 22 lb. with a range of about 1½ miles.

"'Secret weapons and rocket shells,' he added, 'are nothing but a nerve war to scare credulous laymen.'

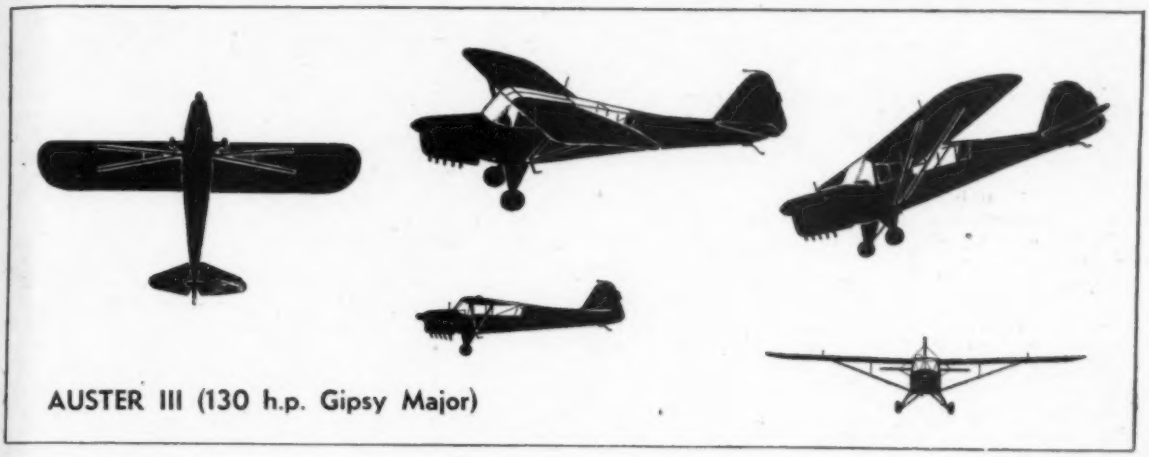
"Two facts emerge, however—(1) the German people have been led to believe implicitly in a secret weapon of vast power; (2) the Germans have built emplacements and installations for some kind of unorthodox weapon along the so-called Invasion Coast of France, and Allied aircraft are continuously bombing the emplacements.

"A reasonable guess may be that Germany has developed a rocket launcher—perhaps something like an enlarged version of the U.S. Army's tank-busting bazooka—and hopes to use it, not for any futuristic terror bombing of London, but for a rapid-fire barrage of explosive projectiles against Allied invasion craft in the Channel."


Everything depends on Accuracy
SMITH'S
AIRCRAFT
INSTRUMENTS

Studies in Recognition

Aircraft in Flying Attitudes

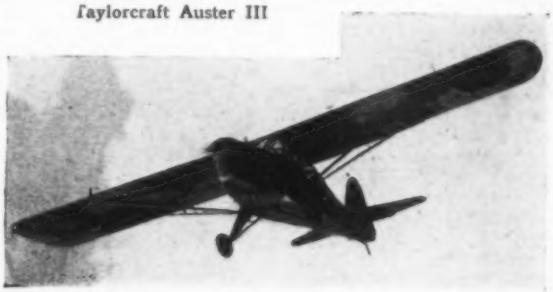


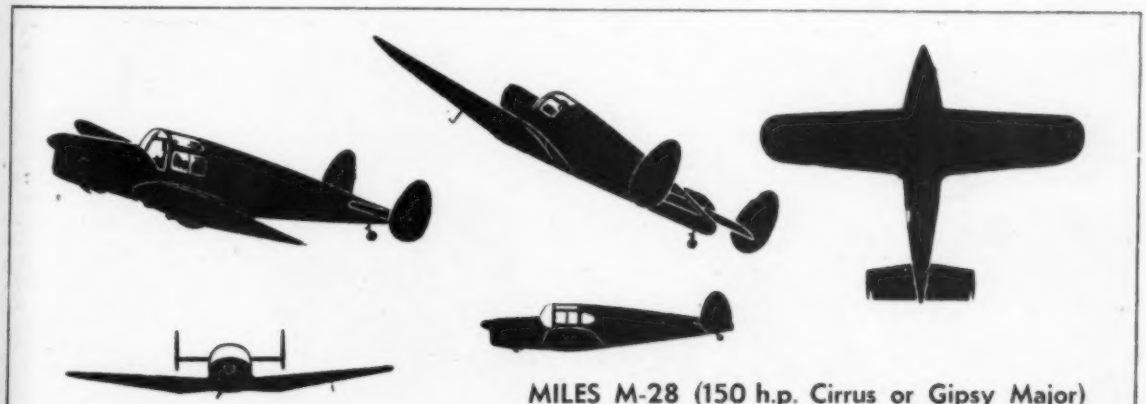
AUSTER III (130 h.p. Gipsy Major)

BRITAIN'S leading "Grasshopper" type, the Taylorcraft Auster III, has proved itself invaluable in spotting for the artillery as well as for liaison and light communications, since it embodies the essential virtues of ability to operate from small spaces, robust construction, and easy maintenance. Its 130 h.p. De Havilland Gipsy Major engine—as sturdy, reliable, and simple as the airframe—gives it a top speed of 126 m.p.h. Landing speed is only 25 m.p.h.

Recognition features are: parallel-edged high wing with round tips and V strut-bracing, sharply tapered tailplane with small round tips, large fin and rudder with equal taper on both edges, and broad round apex. Inverted in-line engine, cabin transparency extended well back, and fixed undercarriage. Dimensions: Span, 36ft.; length, 22ft.; height, 7ft.; wing area, 155 sq. ft.

Taylorcraft Auster III





MILES M-28 (150 h.p. Cirrus or Gipsy Major)

DESIGNED to fulfil the duties of an *ab initio* and/or intermediate trainer and also of a communications aircraft, the Miles M-28 may be equipped as a two- or three-seater, while a four-seater version is also projected. It has side-by-side seating, excellent visibility, nice flying qualities, and low operating costs. The following alternative engines may be fitted: 150 h.p. Cirrus Major or Gipsy Major Series IIA, with fixed-pitch airscrew; Gipsy Major Series III or IIIS, with c.s. airscrew. Top speed is 155 m.p.h. and 176 m.p.h. respectively.

Recognition points include low aspect-ratio wings with slight taper and broad round tips, reverse thickness taper to centre-section giving cranked effect on underside only; egg-shaped twin fins and rudders; wide, tapered fuselage with rounded top; in-line inverted engine. Dimensions: Span, 30ft. 6in.; length, 22ft. 1½in.; height, 8ft. 6in.; wing area, 160 sq. ft.

Miles M-28 Trainer

The Cameron Rotor Plane

Helicopter, Gyroplane and Orthodox Aircraft Combined in One : Retractable Rotor Blades and Variable-incidence Wings

WHEN extolling the virtues of the helicopter type of aircraft (and they have been rather overstressed of late by enthusiasts who mostly do not appreciate the difficulties still to be overcome), the ability to ascend and descend vertically is always the feature most prominently displayed. Undoubtedly this ability is of first-rate importance, and places the helicopter in a class by itself by enabling it to do something which no other type of aircraft can do. But unless the helicopter can, when desired, combine with this unique characteristic a reasonably high forward speed, its utility is likely to be restricted. After all, the main purpose of any type of aircraft is to travel from A to B in safety and at a speed which will enable it to get to its destination in a reasonable time, even should strong head winds be encountered.

Clean aerodynamic design can do something towards improving what may be termed the horizontal performance of a helicopter; but if the rotor is of sufficient diameter and "solidity" to give acceptable rates of climb and descent, the drag is apt to be somewhat high. Many years ago the late Señor de la Cierva laid it down that for maximum efficiency of the Autogiro a combination of rotor and orthodox fixed wing was desirable.

In an endeavour to combine all the best features of the gyroplane, helicopter and fixed-wing aircraft, Mr. Peter Cameron, of Glasgow, has been working for many years on designs of his own, and his latest project is illustrated by the photographs of a working model which accompany this article. The pictures show most of the features of the Cameron 4, although not the one which is fundamental in the design, namely, the rectractable rotor blades. These blades were described in *Flight* as long ago as December 31st, 1936, and are one of the patented features of Mr. Cameron's design.

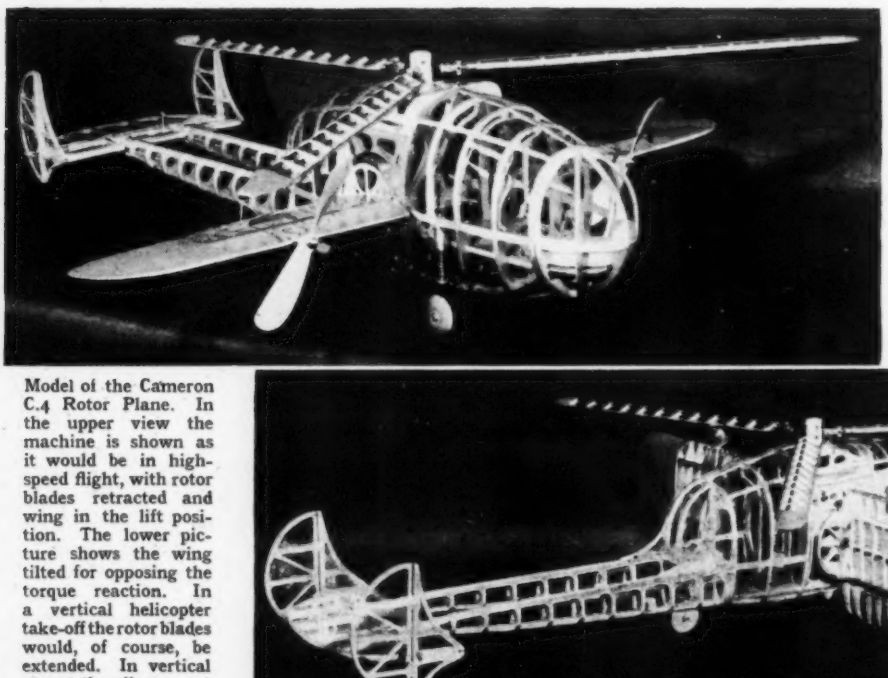
For the size of Rotor Plane represented by the model shown in the photographs, the possible variation of rotor diameter ranges from 40ft., when the blades are retracted, to 74ft., when they are fully extended. It will be appreciated that the disc area swept by the extended blades is thus very large, and gives very high lift for taking off as a helicopter. For cruising the blades would be partially retracted, and for maximum speed they would be fully retracted, the fixed wings in that case being set horizontally and carrying most of the weight. Since the wings are of relatively small size, the wing loading would be high, and consequently the wings would be working at a good lift/drag ratio.

Propulsion is by means of two airscrews mounted in the leading edge of the wings. In horizontal flight they would act as normal airscrews, but when the wings are tilted for helicopter take-off the smaller screws would, of course, contribute a certain amount of direct lift. In this connection it is worth mentioning that when the rotor blades are fully extended their root ends are beyond the area in which the airscrews work, so that these would be operating in undisturbed air.

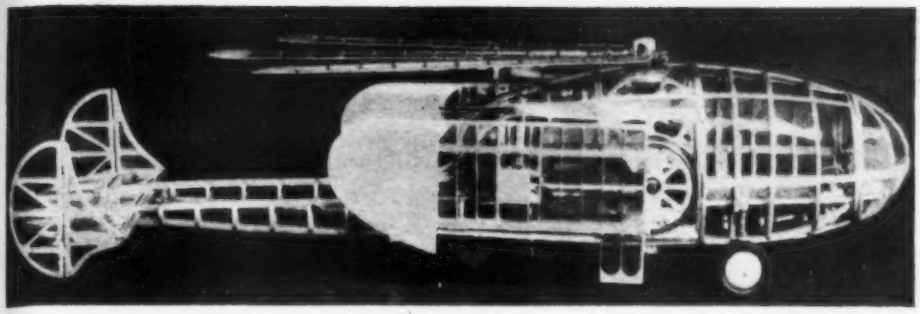
Three Modes of Flight

One may visualise the Cameron Rotor Plane as having three possible modes of flight, although these tend to merge into one another: As a pure helicopter, with rotor blades fully extended and the wings tilted into a vertical position; as a gyroplane, with wings nearly horizontal and the rotor blades partly retracted; and as an ordinary aircraft, with the fixed wings carrying most of the load and the fully retracted rotor blades just autorotating.

Control of the rotor blades is by ordinary joy stick, the movements of which change the pitch angles of the blades. The fixed wings, it will be noted, carry normal ailerons. These will work with the rotor controls in normal horizontal flight, but in helicopter flight they have a further function. The vertical wings serve, by themselves, to oppose the torque reaction from the driven rotor, but ability to turn the machine around its vertical axis is given by the ailerons, which are now in a vertical position and work-



Model of the Cameron C.4 Rotor Plane. In the upper view the machine is shown as it would be in high-speed flight, with rotor blades retracted and wing in the lift position. The lower picture shows the wing tilted for opposing the torque reaction. In a vertical helicopter take-off the rotor blades would, of course, be extended. In vertical ascent the ailerons act as rudders.



For parking the Cameron C.4 the rotor blades and wings are folded back. This view also shows the very substantial wing-root mounting. This would be a heavy item since great loads are concentrated at this point and provision has to be made for changing the wing incidence through an angle of about 90 deg.

ing as directional rudders in the downwash of the rotor.

To sum up, the outstanding features of the Cameron Rotor Plane are its great lift for helicopter flight by virtue of the large-diameter extended rotor, and its low drag with good resulting forward speed when the rotor blades are retracted and the machine is flying mainly "on its wings." In other words, while maintaining its ability to fly at no forward speed, it should have a top speed comparable with that of orthodox aircraft, the saving in drag that results from the small fixed wing being more than enough to compensate for the drag of the retracted and autorotating rotor.

Objections to the scheme are obvious enough. The variable-incidence wings, although small in themselves, will be somewhat heavy because of the necessity for some form of trunnion fixing to the fuselage. The incidence change and the retraction of the rotor blades will, of course, be done by power from the engine. In case of engine failure there will, presumably, be some form of hand-operated emergency gear. It should be possible so to use the centrifugal force that extension of the blades should require little power.

The second point on which one has some doubt is the change-over from helicopter ascent with wings vertical to forward flight with the wings horizontal. The machine would, one presumes, climb to a safe height before the change was made, and then the rotor would be allowed to autorotate while the wing incidence was changed. Mr. Cameron himself was somewhat worried about this aspect, but, in his own words, "strangely enough, these problems, when once solved, turned out to be the simplest of all."

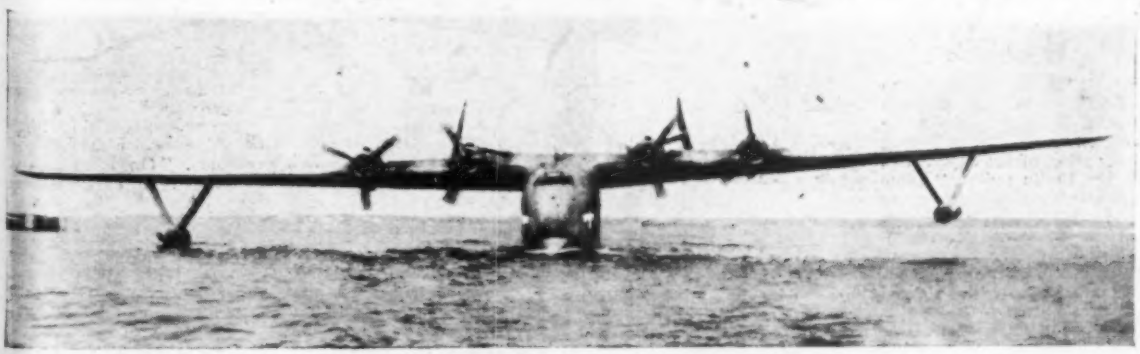
HE DREW "FIRST BLOOD"

THE British pilot to whom fell the honour of bagging the first German aircraft to be shot down in the present war, recently visited the Blackburn factory where was built the Skua he was flying at the time. He gave the workers a personal account of the action.

He was Lt. Cdr. B. S. McEwen, of the Fleet Air Arm, who, 23 days after the declaration of war (he was a lieutenant at that time), shot down a Dornier Do 18 flying boat off the coast of Heligoland whilst flying from the *Ark Royal*. The famous carrier, he said, was part of a strong naval escort sent out to bring home a British submarine damaged by enemy action during the night. All went well until nearly mid-day, when three enemy aircraft were seen shadowing our ships at a respectful distance. Skuas immediately took-off from the *Ark Royal*, and his section soon engaged the Dorniers, which apparently had not seen them coming. The one attacked by himself and his air-gunner, Acting Petty Officer B. M. Seymour, was stooging around near the surface when they swept down on it for the first burst. Coming round for a second attack they found the Hun down on the water, its pilot waving his overalls as a distress signal. Later its crew of four were picked up by one of our ships, which then dispatched the cripped Dornier with a single shell, the two other flying boats having retired from the scene damaged. This, incidentally, was the day on which Goebbels "sank" the *Ark Royal* for the first time.

Left to right: Capt. H. C. Ranald, M.A.P. overseer at Blackburn's, Mr. Robert Blackburn, chairman and managing director, and Lt. Cdr. B. S. McEwen who drew "first blood" of the war in a Skua.

Referring to future possibilities in the Pacific, Lt. Cdr. McEwen said the new machines now coming through for the Fleet Air Arm would help to finish the job, and to the builders he quoted the American slogan, "Keep 'em Flying."



MAIL BOAT RETURNS: The Martin Mars taxying to its buoy on the Patuxent river. It had just returned from a 4,375 miles non-stop flight to Natal, Brazil, with 13,000lb. of mail for the American troops.

Behind the Lines

Service and Industrial News from the Inside of Axis and Enemy-occupied Countries

Spanish Blues

FIGHTER pilots, members of the Spanish Blue Legion serving with the *Luftwaffe*, were recently sent as Goering's guests to an Austrian winter resort to recuperate from the trials of the Russian front.

Surprise

BOMB-HARASSED German workers woke up on the 16th of this month to find a new *ukase* of their beneficent Government: the morning papers told them that henceforth working hours lost during air raids and alerts must be made up to prevent a decline in German industrial production. Moreover, such work continuing beyond the ordinary working hours will not be considered overtime and will not be paid as such.

Another Version

LA SUISSE published this entirely unconfirmed report from the German frontier: "We have received this report of the new German weapon used over London. It is a high-altitude aircraft flying at a height of about nine miles with ability to dive to about four miles and drop several types of bombs, of which one develops inflammable gases whose effect is greater than the R.A.F.'s incendiaries."

Expecting

"JAPANESE air-raid defence headquarters have passed regulations aimed at speeding up air-raid precautions, particularly in the four northern districts of Kiushiu, most southerly of the main Japanese islands," said Tokyo radio, quoted by Reuter. "A.R.P. works scheduled for completion during the year must be completed by June. To ensure this, extensive use must be made of all materials not urgently needed for other construction work. Water supplies and communications between towns and villages must also be improved as a defensive measure."

Impressed

A GERMAN reporter who flew in a German bomber in a recent raid on London gave the following description of his experiences on the Berlin radio: "There is one thing all German crews flying to London know for certain—they will be plunging into a devil's cauldron of defences which will call for the last ounce of courage and skill from each man. Those tense few minutes of struggle against searchlights, flak and night fighters and of unspeakable confusion simply tear one's nerve to pieces."

Explanation No. 1—

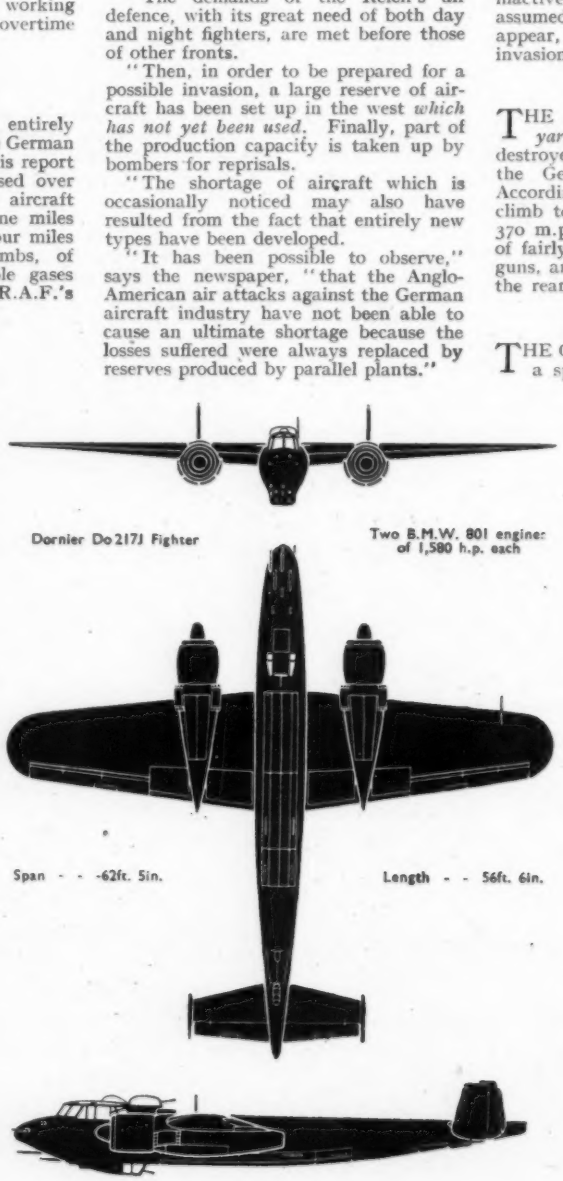
ALARMED Germans asking where are all those aircraft which Dr. Goebbels told them the increased aircraft production and satisfactory man-power have produced, were given this somewhat disappointing answer by a German-controlled newspaper:

"The demands of the Reich's air defence, with its great need of both day and night fighters, are met before those of other fronts.

"Then, in order to be prepared for a possible invasion, a large reserve of aircraft has been set up in the west *which has not yet been used*. Finally, part of the production capacity is taken up by bombers for reprisals.

"The shortage of aircraft which is occasionally noticed may also have resulted from the fact that entirely new types have been developed.

"It has been possible to observe," says the newspaper, "that the Anglo-American air attacks against the German aircraft industry have not been able to cause an ultimate shortage because the losses suffered were always replaced by reserves produced by parallel plants."



—And No. 2

"Part of the mystery so long surrounding the whereabouts of the *Luftwaffe* has now been cleared up," says the *Militaerische Korrespondenz aus Deutschland*. "Certainly it will not be possible straight away to draw conclusions from the renewed activity in the west as to the actual strength of the *Luftwaffe* on this front. This will only become apparent when the attempt at a large-scale landing is made on the coast of Europe."

The reason for the reopening of the air war against Britain on a large scale—says the article—seems to be that *Luftwaffe formations belonging to the anti-invasion forces* must not always remain inactive. Until then it must always be assumed that only some of the forces appear, while the bulk of the anti-invasion *Luftwaffe* remains in readiness.

New Fighter

THE Hungarian newspaper, *Uj Magyarság*, describes a new two-engined destroyer aircraft said to be employed by the Germans against Allied raiders. According to this report the aircraft can climb to 33,000ft. and travel at 310 to 370 m.p.h. It is armed with two guns of fairly large calibre and four machine guns, and carries two automatic rifles in the rear which can be used for defence.

Hairspring Tactics

THE German Air Command has formed a special "'L' Command" headed by experienced officers drawn from the Richthofen Squadron to direct the recent large-scale raids on London, according to the Berlin correspondent of the Swedish newspaper *Aftonbladet*.

Last summer "L" Command began studying methods of penetrating London's defences, and to enable them to obtain information of the barrage and fighter defences of the metropolis, special formations of Messerschmitt and Focke-Wulf fighters were sent over on reconnaissance. One of their greatest problems was countering the blanket barrage which British gunners put up. Formerly the German bombers flew over the barrage, but "L" Command discovered it easier to fly just below the line where the shells burst, a manœuvre they called "hairspring tactics."

The new command is said to be using two new types of bombers. "One is a large six-motored type evolved from the German 'Giant' transport aircraft, the Me 323, and the other is the double-fuselaged Heinkel He 219," says the report, "which produced a sensation in combat with British fighters over France." Four-engined Heinkels are said to form, however, the main proportion of bomber squadrons which use an improved H.E. bomb.

Levered Suspension

Resilience to Both Drag and Vertical Loads Ensures Efficient Operation of the Shock Absorber : An Interesting Undercarriage Development Explained and Reviewed

By R. H. BOUND, F.R.Ae.S., A.M.I.A.E.

THE design of aircraft undercarriages has been the study of specialist firms for a number of years, in parallel with the work of other specialist concerns manufacturing such units as engines, airscrews, gun-turrets and other major components.

The design of retracting undercarriages involves such problems as adequate energy absorption, good taxying characteristics, reliable retracting mechanism and locking gear, and the provision of emergency methods of lowering in the event of failure of the normal system.

Analysis of the telescopic compression leg, which has been in popular use for many years, reveals certain deficiencies which are inherent in the system. In particular, it is impossible so to position the leg that all combinations of vertical load and side loads induced by drift landings, and drag loads due to braking, shall give a resultant loading which is truly axial in the shock absorber. Consequently, the telescopic strut is subjected to bending. This results in deflection with concurrent binding, thus preventing the shock absorber from functioning smoothly.

Problems of dissipating the kinetic energy of vertical descent in landing, together with the provision of a resilient carriage for taxying over surfaces of varying degrees of roughness, have been attacked in a wide diversity of designs and combinations in shock-absorbing media. These range from the early undercarriages using axles sprung by rubber cord to the modern telescopic shock-absorber units.

Levered Suspension Principle

The shock absorber is the mechanical centre of the undercarriage, and the working efficiency of this unit is of primary importance. Unfortunately, due to the complicated nature of undercarriage loadings, the optimum performance of the shock absorber is difficult to realise, but levered suspension has provided a practical solution to the problem and established a smoothly-working undercarriage which is resilient to both drag and vertical loads.

Figs. 1, 2 and 3 illustrate the principle of levered suspension. Fig. 1 shows an undercarriage for a modern bomber. Fig. 2 is a sideways-retracting undercarriage used on one of our latest fighters. Fig. 3 illustrates a levered suspension nose wheel used on one of the latest British aircraft. This unit employs a tension-type shock absorber.

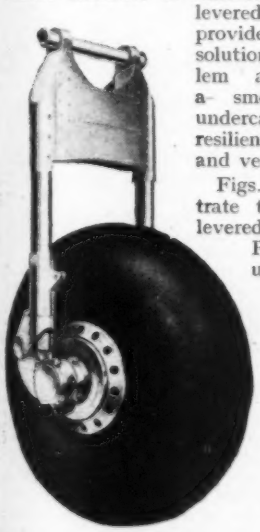


Fig. 1. Levered suspension undercarriage for a bomber.

The arrangement consists essentially of pin-jointing the working parts of the undercarriage so that the shock absorber is pin-jointed to a beam or lever which also carries the wheel, a principle from which this type of landing gear has derived the title "Levered Suspension." The legs in this case, as distinct from the telescopic compression legs illustrated in Fig. 4, are purely structural members to which are attached the swinging arms which form the mounting for the landing wheel. The shock absorbers are attached to these swinging arms and to the legs through the medium of pin joints, movement of the wheel being controlled by the shock absorbers.

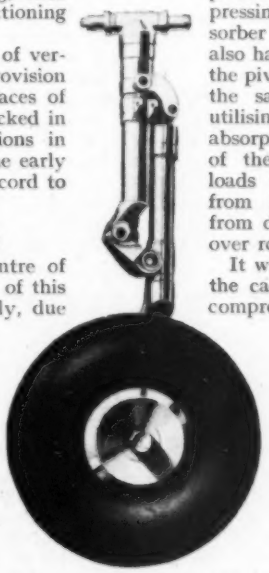


Fig. 2. Sideways retracting levered suspension undercarriage for fighter.

Under the action of vertical loads the wheels swing about the pivot bearing, thus compressing the shock absorber ; drag loads (which also have a moment about the pivot bearing) result in the same movement, so utilising the energy-absorption characteristics of the undercarriage for loads whether they arise from landing impact or from drag due to taxying over rough surfaces.

It will be noted that, in the case of the telescopic compression leg, the shock absorber has nominally the same linear travel as the wheel. With levered suspension this movement of the piston is reduced by an amount corresponding to the leverage ratio, and this results in a smaller and more compact shock absorber.

Fig. 3. Levered suspension nose wheel with tension shock absorber.

The undercarriage must be of a robust construction and provide means for absorbing the shock of landing. In the case of the telescopic leg the shock absorber is integral with the structure, a combination which is not entirely satisfactory as the bending moments, which are inherent with the cantilever-leg undercarriage, can adversely affect the resilient properties of the undercarriage. Levered suspension ensures that the shock absorber is relieved of bending forces which interfere with the working efficiency of the unit.

Hydraulic Shock Absorbers

A few aircraft still rely on rubber for their suspension, usually in conjunction with a friction device to damp rebound action. The efficient ground performance of the wide diversity of aircraft types has, for a number of years, resulted in the fairly general use of a unit consisting of a combination of oil and an energy-storing device. In this arrangement the oil serves the purpose of dissipating the kinetic energy of landing, springing being provided by steel springs, or air.

LEVERED SUSPENSION

When the end loads in cantilever telescopic legs are accompanied by forces normal to the linear travel of the piston, the internal friction between the moving parts of the shock absorber is greatly increased. This increased resistance can prevent satisfactory functioning of the shock absorber, with the result that the tyre must do more work, and as the recoil action of the tyre is undamped, bouncing will occur on landing and uncontrolled springing during taxying.

All semi- and fully-cantilever telescopic legs suffer bending when subjected to drag or side loads. Where the legs have a fore-and-aft rake, the bending moments are appreciable; this is particularly so in the case of tail-wheel units where caster effect is obtained by offsetting the axle.

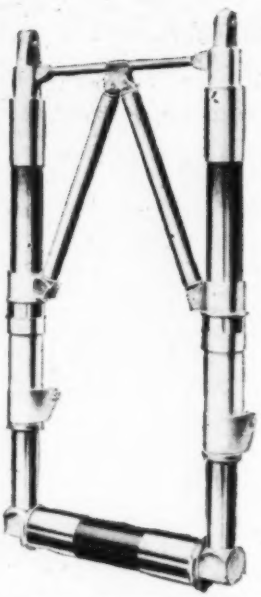


Fig. 4. Telescopic undercarriage for heavy aircraft.

As already described, in levered suspension the shock absorber is pin-jointed at both ends and is therefore only subjected to end loads. This feature is particularly useful in the emergency of sudden braking, as the brake torque reaction and rapid dissipation of energy necessitated by the greatly increased rolling friction is cushioned by the shock absorber. This cushioning also provides greater comfort for the crew or passengers when taxying over rough ground.

In many cases levered suspension has relieved the aircraft designer of problems associated with undercarriage retraction. The shock absorber can be installed in a variety of positions, and can, within certain limits, be used singly or in duplicate, depending upon the undercarriage layout.

The accompanying illustrations of some levered suspension designs show that the system permits great flexibility in the geometric layout, and in many applications the overall height of the undercarriage can be reduced to less than that required by the equivalent telescopic leg. The overall length of the detachable shock absorber is about one-quarter of the telescopic leg unit. This reduced length effectively eases manufacturing and production problems, as the shock absorber unit is particularly convenient to handle for assembly, whilst for machining, the cylinder bores are short.

Fig. 5. Levered suspension undercarriage made from welded steel pressings.

Suitability for Standardisation

The compactness and simplicity of a unit assembly of shock absorber, axle, links and brake torque anchorages, etc., have made the system eminently suitable for standardisation to cover a wide range of aircraft sizes. The servicing aspect is considerably improved as it is only necessary to jack up the aircraft a few inches to replace a shock absorber. The necessity to disconnect the retracting struts and remove the complete shock-absorber panel, inherent with the telescopic-leg system, is eliminated.

Standardisation of the mechanical parts permits interchangeability, and the unit assembly of shock absorber and attachment fittings is a great convenience for handling and storage. Levered suspension provides an economical structure, and Fig. 5 shows the mounting struts, produced from steel pressings welded together, forming a tapered strut.

BOOK REVIEWS

"War Models," by C. P. Dixon; Scalecraft; 2s.

MAKING solid scale models of aircraft is quite a popular hobby these days and it has a very useful application in aircraft recognition. This little book, although avowedly intended primarily for the benefit of those using Scalecraft kits, is full of useful tips for all model makers.

Bombing Vindicated. By J. M. Spaight, C.B., C.B.E., late Assistant Secretary, Air Ministry. Geoffrey Bles. 6s. net.

THE argument of this book is that the bomber is the saver of civilisation. not its destroyer, as many in the inter-war years prophesied that it would be. The idea apparently is that a victory by Hitler would have destroyed civilisation and that British and American bombing has prevented that catastrophe. That would seem to imply a belief on the author's part that strategic bombing has been the main factor in Hitler's forthcoming downfall, but Mr. Spaight does not commit himself in so many words to that doctrine.

The book emphasises throughout the difference between what is commonly called strategic bombing on the one hand and bombing in connection with military operations on the other. The author believes that Hitler was from the first afraid of strategic bombing and did his best to get it ruled out by international agreement; while he clung to all other forms of bombing (e.g., Warsaw, Rotterdam, Belgrade) because he believed that they would advance the German march to victory. Not everyone will agree with Mr. Spaight in taking Hitler's words as expressing the thoughts of his mind.

One strong point which Mr. Spaight makes is that the blows struck at Germany ought to discourage the Germans from entering upon another war even in the distant future. He does not, however, consider this other point. In this war, as Mr. Spaight emphasises, Britain was preparing to engage in strategic bombing so soon as she had mustered sufficient strength, while Germany was not. In the future some enemy may reverse that position, and then Britain (the island kingdom) would be in great danger—unless by that time air defence had become capable, in Mr. Churchill's words, of "clawing the bomber down from the sky." Failing that, bombing would then be not the saver but the wrecker of civilisation—at least in Britain.

Ace Air Reporter. By Harry Harper. John Gifford, Ltd. 8s. 6d. net.

MR. HARRY HARPER was the first journalist to devote his whole time and energies to studying and reporting air events and air progress. This fact presumably accounts for the use of the word "Ace" in the title of his book—the allusion being rather to a pack of cards than to the sense in which French and American fighter pilots use the word.

The book is declared in the author's foreword to be one of personal recollections, and Mr. Harper sticks closely to that text until he comes to the last two chapters, which deal with the R.A.F. in the last war and after, and with the coming age of the air. In these two chapters he writes not of personal memories, but historically, prophetically, and sometimes in challenging strain. They are interesting; but on the whole we prefer the personal reminiscences.

Mr. Harper has had an extraordinarily interesting life, and has seen the birth of something new and great. His tales of Santos-Dumont, Bleriot, the Wright brothers, Grahame-White, Henry Farman, and many others make attractive reading. The art of flying has advanced very far since their day, but many of the early pioneers are still in the land of the living. To the young pilot just trained in Canada to fly a Mustang the stories in this book will perhaps seem rather like "1066 and All That"; but it will do him good to read them.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

JET PROPULSION OF AIRCRAFT

Gunpowder is a Too Expensive Fuel

YOUR correspondent "Driver" is quite correct when he says that gunpowder should give better expansive economy than spirit or other more common fuels. I went into this matter with a well-known firm of gunsmiths in about 1929 and found that gunpowder would actually be a far better means of producing pressure in, say, a locomotive boiler than generating steam in the usual laborious manner.

The only snag to this scheme was the price of gunpowder, which is, of course, produced in very small quantities in peacetime. No doubt chemists could even improve on gunpowder as a power generator—something that burns a bit more slowly. The many other advantages would also follow naturally.

J. R. GOULD.

An Early Naval Experiment

AFTER reading various letters in *Flight* with reference to jet propulsion, it occurs to me that the bulk of your readers may not be aware that the first commercial experiments in jet propulsion were probably made by the British Navy—although the medium in this case was water.

In 1866 the Admiralty built two gunboats, the *Water Witch* and the *Viper*, with a displacement of 1,200 tons each. The *Viper* was a perfectly normal screw-propelled boat of 696 i.h.p. with a speed of 9.58 knots. The *Water Witch* drew in water through a vertical opening amidships and discharged astern through two 2ft. nozzles. The engines produced 760 i.h.p. and gave a speed of 9.3 knots. As will be seen, the efficiency was below that of the screw propeller. Had modern developments in centrifugal pumps been available at that time it is possible that jet propulsion would have been more successful than the screw. At any rate, the Senior Service does seem to have made an early start in this field.

R. FIELDHOUSE.

Comparative Efficiency of Jet and Rocket

AS a further contribution towards the problem of calculation of reaction-propulsion efficiencies, I append the following notes which may be of interest to the readers of your publication.

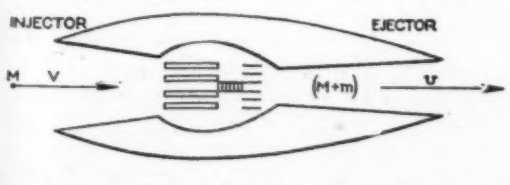
In the case of a purely rocket-propelled vehicle it is not advisable to calculate the efficiency by comparing the work done in moving the body through space, with the work done in the jet, because in the normal exponential rocket the velocity is varying at each instant in accordance with the equation $V_t = v \log_e Mo/(Mo - wb)$ and the efficiency so calculated would vary likewise. Some figure could be obtained by integration, but experimenters usually compare thermal efficiencies of rocket motors, and this is perhaps the more sensible method.

For a pure rocket motor, without air injectors, this thermal efficiency (E_{rmR}) is given by the ratio between the kinetic energy in the efflux and the chemical energy in the fuel:—

$$E_{rmR} = \frac{m.v^2}{2Z}$$

where m is the efflux mass, v is the efflux velocity relative to the motor, and Z is the chemical energy of the fuel per unit mass.

With a jet-propelled aircraft, conditions are slightly different, but the same principles apply.



With reference to the figure which represents a jet-propelled aircraft moving through air at a velocity V, it is necessary to measure all velocities relative to the aircraft. It can then be considered as stationary and V represents the velocity of flow of the intake, and M will represent the mass of intake. This air passes through the motor, is increased in mass by the addition of burnt fuel, and should be ejected with a velocity (v) which is greater than V.

The energy in the jet will be given by

$$E_j = \tfrac{1}{2}(M + m)v^2$$

when m is the mass of fuel ejected with the air (M). For the purpose of comparisons and to calculate the efficiency, it is necessary to subtract from this the energy in the air scooped in at the nose of the machine.

This energy will be given by

$$E_a = \tfrac{1}{2} M.V^2$$

and the resultant energy available for propulsion is,

$$E_p = \tfrac{1}{2}(M + m)\,v^2 - \tfrac{1}{2} M.V^2$$

If this energy is compared with the thermatical chemical energy in the fuel, the thermal efficiency E_{rm} is

$$E_{rm} = \frac{v\,(M.v + m.v) - M.V^2}{2Z}$$

The propulsive efficiency of such an aircraft will be the ratio between the work done in moving the body through space and the energy in the jet, namely

$$P_E = \frac{2V\,(v(M + m) - V.M)}{v(Mv + mv) - M.V^2}$$

and the aggregate efficiency of the whole arrangement will be the product of the thermal efficiency and the propulsive efficiency,

$$A_g.E = \frac{V\,(M.v + m.v - M.V)}{Z}$$

which is what would be expected, namely that the final efficiency is the ratio between the total work done in moving the aircraft and the potential chemical energy of the fuel.

In a jet-propelled aircraft v will always exceed V, and in the limit when v = V then the engine will be very inefficient, for the air is just passing through the machine, and the propulsion is effected by the addition of a mass m and not by any change in the air passing through the motor. The effective thrust would be equal to m.v; as for a pure rocket, and as v would be much less than the theoretical value obtainable from the fuel in a pure rocket system, the efficiency would be low.

The other limit when the ratio of v to V is infinitely great, means that as v is limited by the fuel, V must be very small, tending towards zero. Again, the machine is inefficient, for fuel is being burnt but no motion of the aircraft results. This time it is the propulsive efficiency that is small, and hence the aggregate efficiency at both limits is low. A compromise has, therefore, to be made, and the maximum efficiency will be found somewhere between these limits of $\frac{v}{V} = 1$ and $\frac{v}{V} = \alpha$.

I cannot imagine a jet-propelled aircraft moving with a velocity greater than its efflux velocity, unless it uses a great deal of fuel and tends towards a rocket-propelled craft. As soon as V exceeds v then the energy available for propulsion will become negative, *unless* m is taken into account and becomes an appreciable value. If such conditions did arise then the advantages of jet-propulsion would not be present, and rocket-propulsion could be employed at a less cost. Jet-propelled aircraft should, therefore, be expected to operate at velocities lower than the theoretical jet velocity of any fuel, and rocket-propelled vehicles will, of course, function quite effectively at velocities greater than the theoretical jet velocities.

E. BURGESS (M.A.A.).

"SORTING OUT THE SNAGS"

Testing Rigs for Routine Inspection

"INDICATOR'S" conception of snag hunting appears to be somewhat distorted, and apparently, given a chance, he would endeavour to evolve some sort of mechanical fault diagnosing contraption for use on the tarmac which one might imagine to be a cross between the products of Messrs. H. G. Wells and Heath Robinson.

In his article "Sorting Out the Snags" in the March 9th issue of *Flight* he has left the impression that aircraft still retain a shadow of uncertainty and that to be a safe pilot one has to be mechanically minded; this, of course, is not the case. It amazes me how he can display such unconstructive voluminosity.

The general idea, however, as far as I can see, is to reduce the cost of aircraft maintenance by eliminating the necessity for technical personnel appearing on the scene when a snag does crop up, or at least eliminating the necessity for a technical discussion on the subject.

Personally I have never seen a "bunch of experts scratching

CORRESPONDENCE

their heads for hours and having everything in the world pulled to pieces to locate a mysterious snag" other than on a prototype, and then the decision is usually instantaneous.

On the other hand, I must admit that since the war broke out and the technical demand became larger than the supply, I have seen a bunch of semi-skilled diagnosticians practising the art of elimination preceded by lengthy discussions of a so-called technical nature, but with the cessation of hostilities and the control of A.I.D. and A.R.B. normal, I am sure that such incidents will disappear.

There are rigs, etc., in existence for testing nearly every fault that could crop up, and these are used for routine inspection purposes on initial assembly and during the annual C. of A. inspection; and, what is more, none of these rigs is incapable of being taken on to the tarmac.

To quote a couple of examples which have been used by "Indicator." The air-speed indicator can be, and is, tested in the airframe as a complete unit by means of a calibrated U-tube, and you can guarantee the satisfactory working of the instrument prior to flight.

The engine revolution indicators on multi-engined aircraft are checked by simply changing over the contacts behind the electrical indicators and comparing one with another, and any fault can be traced immediately. On a single-engined aircraft the instrument can easily be checked against a stroboscope. Again, these checks are done *in situ* and prior to flight.

The main point I would like to stress is that the engineer can tell the pilot that his machine is 100 per cent. and mean it, and the point I would like to make really clear is that if the engineer is doing his job properly, then the only real need for a test flight on any subsequent aircraft is to satisfy the riggers that the machine is in trim.

W. D. BLACKBURN.

THE MUSTANG'S RANGE

Escorting Bombers to Berlin

THE caption under the photograph of a P51B N.A. Mustang III (R.R. Merlin LXVIII) in the issue of *Flight* dated March 16th states that the fighting radius of the Mustang III (with long range tanks) exceeds 450 miles. Actually this is an under-statement as its fighting radius (with L.R. tanks) is nearly 600 miles. This is borne out by the fact that Mustangs III were among the L.R. fighters which escorted the American heavy bombers to Berlin in the recent daylight raids.

The figures below show how the Mustang achieves its great range.

Normal fuel tankage	141 gals.
Two wing (external) tanks (75 gals. each)..	150 gals.
	291 gals.

J. L. COVERDALE.

[The figures given in our caption were taken from the official inscription issued with the photograph.—ED.]

WORLD'S BEST AIRCRAFT

Pro-Masefield Comment

THERE appears to be some muddled thinking among your correspondents on Mr. Masefield's analysis of the "World's Best Aircraft." Some of them have discussed very odd aircraft as candidates for some of the categories in substitution for Mr. Masefield's choice.

The following have been suggested:

	MR. MASEFIELD	CORRESPONDENTS
SINGLE-SEAT FIGHTER ..	P-51B Mustang III	Typhoon IB, Spitfire IX
FIGHTER-BOMBER ..	P-38J Lightning	Hurribomber, Typhoon, Ju 88, Me 210
LAND-BASED TORPEDO-BOMBER	Beaufighter X	Hampden
TWO-MOTOR ATTACK-BOMBER	B-25H Mitchell	Mosquito, Hurricane
LONG-RANGE TRANSPORT	Skymaster	York
HEAVY DAY BOMBER ..	B-24J Liberator	B-17G Fortress

Let us compare these. The Merlin-Mustang is faster than the Typhoon IB or Spitfire IX, fine aircraft as those are. The Mustang has a longer range (it has proved itself in action over Berlin). It can carry two bombs in place of external fuel tanks. It has a ceiling of 40,000ft. It is cheap to produce and easy to maintain. It has adequate fire power—a fine Anglo-American effort only beaten by the new Griffon-Spitfire. Incidentally, reliable as the Sabre engine now is, it must always be a maintenance headache, and it is not supercharged to so great a height as the Merlin 61 or 68. So my selection would be the Mustang III.

For a fighter-bomber you want chiefly speed, hitting power and bomb load. I learn that two 1,000 lb. bombs can be carried by Lightning fighter-bomber squadrons in the Pacific. The P-38J has been operating for some time with very heavy loads over long ranges, doing a genuine maximum of 400 m.p.h.+, at height, and able to come back on one engine when a single-engine fighter-bomber would be lost. Over the sea, as in the Pacific, that counts for a lot in morale. We may see the Lightning to good effect as a fighter-bomber nearer home when the Second Front opens. The fine old Hurribomber is not in the same class. But the Typhoon would run it close except that twin-engine safely tips the balance.

I do not think anyone need take a comparison between the Beaufighter X and the Hampden seriously as a torpedo-bomber. Even with its torpedo outside, the "Beau" is far faster and, of course, much more lethally armed.

The Mosquito is probably the most outstanding aircraft in the world to-day. But for attack-bombing and ground and ship strafing the B-25H Mitchell with 14 0.5in. machine guns, one 75 mm. cannon, and a substantial load of bombs is surely unrivalled.

Although the York is a fine effort as a wartime conversion for a transport it is admittedly only a stop-gap until better things come along. The Skymaster, designed from the first for the job, flies a good deal farther than the York with a heavier load at about the same speed. We *can* do better than the Skymaster—but we have not done so yet.

I see no evidence that Mr. Masefield said the Liberator was better than the Lancaster. In fact, he did not compare the two. He says the Lancaster is the world's best night bomber. Nobody would deny that. But by day the Liberator is extraordinarily versatile—long-range day bomber, "VLR" ocean patrol bomber, and (as the C-87) a useful long-range transport. An aircraft which bombs Berlin by day, hunts submarines throughout the Atlantic and Pacific and acts as a transport all over the world can surely be classed as one of the outstanding present-day types.

C. A. GLASSHOUSE.

BOUNDARY LAYER CONTROL

Variation in Slot Position Required

BEING very interested in the development of jet propulsion and the application of boundary layer control, I should like to know if any of your readers have considered the following points.

As the region of breakdown from laminar flow to turbulence would appear to vary its position in proportion to the speed of the aircraft through the atmosphere, the optimum point at which the control slot should be placed will vary. Thus with a fixed slot the efficiency of the control scheme would be maintained only within a fairly small speed range.

To counteract this a means should be provided for variation in the slot position, or, alternatively, provide, say, two slots in preference to the perforated strip type of surface, as the latter would appear to cause extra drag. One of the slots would be at the optimum position for economical cruising speed, and the other for maximum speed. Selective control, or perhaps even automatic control, could be applied to close the slot which is not required.

On the other hand I am unable to say whether the variation in drag and aerodynamic efficiency would warrant such refinements.

Incidentally, can it be possible that the application of boundary layer control has been adopted for the production of large bombs, as the pictures recently published of the 12,000lb. bomb show what might be control slots at positions roughly one-third and two-thirds of the length of the bomb. This seems to be a fairly good scheme for ensuring that such an apparently awkward shape is satisfactorily "streamlined" without detracting from the internal capacity. Without these slots the bomb may be very inaccurate due to the turbulent wake, and the drag would also tend to lessen accuracy.

Whether or not the latter is true can only be determined with the co-operation of the Air Ministry, but in any event it appears that a good deal of careful thought goes into the production of bombs.

"PIRATE."

Aircrews lend a hand to clear the snow away at a Lancaster station during the severe weather in February.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News and Announcements

Awards

THE KING has been graciously pleased to approve the following awards in recognition of gallantry and devotion to duty in the execution of air operations:—

Distinguished Service Order

Act. Wing Cdr. A. D. McN. BOYD, D.F.C., R.A.F.V.R., No. 219 Sqn.—This officer assumed command of his squadron in March, 1943. He has been engaged in operational flying for the greater part of the war, and since the award of the D.F.C. in January, 1942, he has destroyed seven enemy aircraft, damaging others. His squadron has, while under his leadership, played an important part in successful operations during the Tunisian and Sicilian campaigns. Wing Cdr. Boyd has always displayed outstanding courage and initiative in action, together with sound administrative ability on the ground.

P/O. F. W. GALLAGHER, R.A.F.V.R., No. 207 Sqn.—This officer and airman were pilot and flight engineer respectively of an aircraft detailed to attack Brunswick one night in January, 1944. When crossing the enemy coast, one of the aircraft's engines became unserviceable. Despite this, P/O. Gallagher continued his mission. When approaching the target a fighter was sighted. The enemy aircraft was closing in, but P/O. Gallagher held to a straight course in order to ensure accurate bombing. When the bombing run was completed, evading action was taken. The fighter continued to attack for a further 25 minutes, by which time P/O. Gallagher's aircraft had sustained heavy damage and two engines were out of action. Nevertheless, course was set for home. Some time later, the aircraft was subject to considerable anti-aircraft fire. A shell burst near one of the wings and the port aileron was hit by shrapnel and became jammed. The cowling top cover of the starboard inner engine was also hit and thereafter hung loose. The aircraft became difficult to control and height was gradually lost. Much movable equipment was jettisoned in an effort to maintain height and the North Sea was crossed. When approaching base, P/O. Gallagher ordered his crew to crash positions. Flt. Sgt. Stewart, who had rendered great assistance so far, elected to remain and assist his captain in landing the aircraft. The task was successfully accomplished but, as the aircraft touched down, one of the landing wheels came off. The crew, except Flt. Sgt. Stewart, who was slightly hurt, escaped injury. In most difficult circumstances, P/O. Gallagher displayed skill, courage and determination of the highest order and Flt. Sgt. Stewart's exemplary conduct and devotion to duty were highly commendable.

Wing Cdr. A. D. McNeill Boyd, D.F.C., No. 219 Squadron, who has been awarded the D.S.O. The official citation appears on this page.

Bar to Distinguished Flying Cross

Sqn. Leader A. I. H. LYNCH, D.F.C., R.A.F.V.R., No. 44 Sqn.—This officer was the pilot of an aircraft detailed to attack Berlin one night in December, 1943. On the bombing run the aircraft was hit by shrapnel and one of its engines was rendered useless. In spite of this, Sqn. Ldr. Lynch made another run over the target. The aircraft was again hit. The greater part of the mid-upper turret cupola was torn away and other damage was sustained. Nevertheless, Sqn. Ldr. Lynch pressed home his attack and afterwards flew the damaged bomber to base where he effected a masterly landing.

Act. Wing Cdr. J. A. A. READ, D.F.C., R.A.F.O., No. 108 Sqn.—Wing Cdr. Read has proved himself to be an outstanding night fighter pilot and leader during the intensive operations in the invasion of Sicily. He has destroyed three enemy aircraft since being awarded the D.F.C., bringing his total victories to at least ten enemy aircraft destroyed. Throughout two tours of operational duty this officer has displayed keenness, courage and devotion to duty of the highest order.

Distinguished Flying Cross

Act. Flt. Lt. J. A. DAY, R.A.F.V.R., No. 156 Sqn.

Act. Flt. Lt. L. FISH, D.F.M., R.A.F.V.R., No. 138 Sqn.

Act. Flt. Lt. R. E. HIDDERLEY, R.A.F.V.R., No. 49 Sqn.

Act. Flt. Lt. J. A. HOWARD, R.A.F.V.R., No. 619 Sqn.

Act. Flt. Lt. F. W. KENRICK, R.A.F.V.R., No. 77 Sqn.

Act. Flt. Lt. J. W. KERR, R.A.F., No. 199 Sqn.

Act. Flt. Lt. F. J. ROBERTS, R.A.F.V.R., No. 97 Sqn.

Act. Flt. Lt. T. W. ROWLAND, R.A.F.V.R., No. 101 Sqn.

Act. Flt. Lt. E. H. SHATTOCK, R.N.Z.A.F., No. ? Sqn.

Act. Flt. Lt. R. L. WAKE, R.A.F.V.R., No. 108 Sqn.

Act. Flt. Lt. J. W. WILKINSON, R.A.F.V.R., No. 35 Sqn.

Act. Flt. Lt. C. T. WILSON, R.A.F.V.R., No. 97 Sqn.

F/O. P. H. ACKLING, R.A.F.V.R., No. 158 Sqn.

SERVICE AVIATION

F/O. J. ASHBROOK, R.A.F.V.R., No. 102 Sqn.
F/O. J. P. BILLING, R.A.F.V.R., No. 97 Sqn.
F/O. W. BODEN, R.A.F.V.R., No. 50 Sqn.
F/O. L. W. N. BOOTH, R.A.F.V.R., No. 97 Sqn.
F/O. D. E. BRAYBROOK, R.A.F.V.R., No. 12 Sqn.
F/O. W. G. COOPER, R.A.F.V.R., No. 97 Sqn.
F/O. J. M. DICKS, R.A.F.V.R., No. 50 Sqn.
F/O. H. DREW, R.A.F.V.R., No. 626 Sqn.
F/O. K. GILL, R.A.F.V.R., No. 9 Sqn.
F/O. T. B. GITTINS, R.A.F.V.R., No. 196 Sqn.
F/O. C. D. GOUGH, R.A.F.V.R., No. 7 Sqn.
F/O. J. D. GRAY, R.A.F.V.R., No. 76 Sqn.
F/O. W. J. O. GRIME, R.A.F.V.R., No. 467 (R.A.A.F.) Sqn.
F/O. J. D. HARRIS, R.A.F.V.R., No. 49 Sqn.
F/O. D. J. HEWLETT, R.A.F.V.R., No. 102 Sqn.
F/O. M. W. JONES, R.A.F.V.R., No. 51 Sqn.
F/O. L. KINGMAN, R.A.F.V.R., No. 12 Sqn.
F/O. S. E. NEVILLE, R.A.F.V.R., No. 405 (R.C.A.F.) Sqn.
F/O. H. S PORTSMOUTH, R.A.F.V.R., No. 153 Sqn.
F/O. P. W. T ROWLAND, R.A.F.V.R., No. 192 Sqn.
F/O. J. J SAYNOR, R.A.F.V.R., No. 97 Sqn.
F/O. A. SCRIVENER, R.A.F.V.R., No. 76 Sqn.
F/O. J. G. SIMPSON, R.A.F.V.R., No. 467 (R.A.A.F.) Sqn.
F/O. A. E. WHETTER, R.A.F.V.R., No. 97 Sqn.
F/O. A. WINSKILL, R.A.F.V.R., No. 419 (R.C.A.F.) Sqn.
P/O. H. R. E. ALSOP, R.A.F.V.R., No. 158 Sqn.
P/O. G. A. ANDERSON, R.A.F.V.R., No. 12 Sqn.
P/O. R. L. ASH, R.A.F.V.R., No. 44 Sqn.

Distinguished Flying Medal

Flt. Sgt. C. E. D. STEWART, R.A.F.V.R., No. 207 Sqn.—For citation see P/O. GALLAGHER, D.S.O.
Sgt. D. W. MCMILLAN, R.A.F.V.R., No. 78 Sqn.
Flt. Sgt. A. CLIBBERY, R.C.A.F., No. 417 (R.C.A.F.) Sqn.
Sgt. R. E. QUALLE, R.C.A.F., No. 427 (R.C.A.F.) Sqn.
Flt. Sgt. J. ANGUS, R.C.A.F., No. 15 Sqn.
Sgt. L. MARSH, R.A.F.V.R., No. 103 Sqn.
Flt. Sgt. H. TODD, R.A.F.V.R., No. 199 Sqn.

THE KING has been graciously pleased to approve the following awards:—

Distinguished Service Cross

Act. Flt. Lt. J. F. LANG, R.A.F.V.R.

Distinguished Service Medal

Flt. Sgt. J. N. F. EDWARDS, B.E.M., R.A.F.

THE KING has been graciously pleased to approve the following awards with effect from January 20th, 1944, in recognition of gallantry displayed in flying operations against the enemy in New Guinea:—

Distinguished Flying Cross

Wing Cdr. G. D. NICHOLL, R.A.A.F.
Act. Flt. Lt. I. S. LOUDON, R.A.A.F.
Act. Flt. Lt. G. N. READ, R.A.A.F.

THE KING has been graciously pleased to approve the following awards in recognition of gallantry displayed in flying operations against the enemy in the Solomon Islands:—

Distinguished Flying Cross

F/O. D. F. AYSON, R.N.Z.A.F.
W/O. W. N. WILLIAMS, D.F.M., R.N.Z.A.F.

Distinguished Flying Medal

Flt. Sgt. G. E. HANNAH, R.N.Z.A.F.

THE KING has been graciously pleased, on the advice of His Majesty's Australian Ministers, to approve the following awards in recognition of brave conduct:—

B.E.M. (Mil.)

Sgt. E. J. DALY, R.A.A.F.
Sgt. B. V. MCLEAN, R.A.A.F.

THE KING has been graciously pleased, on the advice of His Majesty's New Zealand Ministers, to approve the following award in recognition of brave conduct:—

B.E.M. (Mil.)

Cpl. T. N. NEWTH, R.N.Z.A.F.

Foreign Decorations

THE KING has granted unrestricted permission for the wearing of the undermentioned decoration conferred upon the officers indicated in recognition of valuable services rendered in connection with the war:—

Conferred by the Belgian Government

Croix de Guerre, Belge, 1940

Act. Wing Cdr. J. K. BUCHANAN, D.S.O., D.F.C., R.A.F.O.
Act. Sqn. Ldr. R. RANKIN, D.F.C., R.A.A.F.

Roll of Honour

Casualty Communiqué No. 363.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Of the names in this list, 112 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—F/O. A. D. Bull; Sgt. L. Collingwood; Sgt. W. A. Didluck; Sgt. E. Evans; F/O. R. D. Fearns; Sgt. W. J. Frewin; Sgt. J. T. Hood; Sgt. F. R. Hughes; F/O. K. S. Judd; Sgt. J. McCourt; Flt. Sgt. R. C. MacGillivray; Flt. Sgt. A. J. M. Millichip; Flt. Sgt. J. A. W. Scott; Sgt. J. C. Simpson.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. R. E. Bradshaw; Sgt. T. I. L. Dagg; Sgt. G. A. Denney; Sgt. F. Hill; Sgt. L. Howarth; Sgt. C. V. L. R. Hulbert; Sgt. T. R. Jones; Sgt. D. M. Lewis; Sgt. C. A. Morris; P/O. R. G. Pearcey; Sgt. G. J. Samuel; F/O. M. F. Scantlebury; Sgt. J. A. Sykes; Sgt. A. Tooth; Sgt. J. S. White.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. D. E. Alford; Sgt. V. H. Archer; Sgt. J. H. Armstrong; P/O. W. S. Ashworth; Sgt. R. J. Bailes; Sgt. E. G. F. B. Baker; Sgt. D. W. E. Batch; Flt. Sgt. H. Bell; Sgt. A. W. Booth; P/O. E. Booth; Sgt. D. Brown; Sgt. E. Cadmore; Sgt. N. W. S. Clack; F/O. D. Coales; F/O. G. W. Cooper; P/O. H. E. Cross; Sgt. J. C. Cunningham; Sgt. E. Dangerfield; Sgt. J. G. S. Dutton; Sgt. G. Eastwood; Sgt. R. V. Emerson; Flt. Sgt. C. Entwistle; P/O. J. G. Ethelston; F/O. D. W. H. Evans; P/O. S. C. Eyles; Sgt. H. C. Fazakerley; Sgt. D. A. H. Ferguson; Sgt. F. R. Fowler; Sqn. Ldr. J. B. Flowerdew; P/O. D. R. Fullager; Sgt. N. W. Fyfe; Wing Cdr. J. R. Gilliman; P/O. D. V. Hamer; Sgt. R. Hammond; Sgt. R. H. Harris; Act. Sqn. Ldr. G. B. Haywood; Flt. Sgt. J. G. Hibbert; Sgt. J. R. Hough; Flt. Lt. I. S. Jenks; Sgt. F. Johnson; Sgt. J. Kirkman; Flt. Sgt. H. C. Lamacraft; Sgt. J. Leedham; Sgt. J. R. Leigh; Sgt. G. L. Lennox; P/O. K. Madin; Flt. Sgt. J. G. H. Mansell; Sgt. L. Martin; Sgt. R. T. Moore; Sgt. P. W. J. Morrow; Sgt. W. Morse; Act. Flt. Lt. E. G. Mortenson; Sgt. D. W. Neal; Act. W/O. N. Nixon; Sgt. K. Norris; Sgt. F. J. North; Sgt. R. K. B. Muir; Sgt. D. O'Loughlin; Sgt. J. W. Ousley; Sgt. D. S. Phillips; Sgt. J. H. Pickles; F/O. R. R. Reid; Sgt. J. Renwick; Sgt. D. Sanders; Sgt. C. V. Scadden; Flt. Sgt. W. R. Scott; Sgt. G. G. Shepherd; F/O. P. B. Smith; Sgt. M. B. Squires; Sgt. C. H. C. Stapleton; P/O. F. R. H. Tate; Flt. Sgt. F. E. Tiller; Sgt. N. K. Underwood; P/O. R. W. Ward; Sgt. K. R. A. Whitcombe; Sgt. R. S. White; Sgt. R. W. Wilcockson; Sgt. C. Wilde.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—P/O. C. J. Dibden.

MISSING, BELIEVED KILLED IN ACTION.—F/O. P. G. W. Goode; Sqn. Ldr. M. P. C. Holmes, D.F.C.; F/O. D. B. Hume; Flt. Sgt. K. M. O. King; Sgt. E. H. Oliver; Flt. Sgt. R. G. Phillips; Flt. Lt. D. W. J. Reynolds.

MISSING.—Sgt. O. A. Acombe-Hill; Sgt. G. H. Adamson; Sgt. E. H. Alcock; Sgt. E. E. Appleby; Sgt. J. A. Atkinson; Sgt. F. A. Aver; Sgt. E. E. Baron; Sgt. K. Bartholomew; Sgt. R. J. Batham; Sgt. W. Beach; P/O. J. Berger; Act. Flt. Lt. G. W. S. Borthwick; Sgt. T. Bowden; Flt. Sgt. A. E. Broomfield; Sgt. D. Brown; P/O. A. J. Burcham; P/O. A. Chaulk; W/O. L. Christie; F/O. J. Clark; Sgt. R. G. W. Climo; Sgt. E. Colwill; P/O. R. J. Cook, D.F.M.; Sgt. P. G. Copping; P/O. K. F. Cornwell, D.F.C.; Sgt. G. J. Davies; Sgt. J. Davies; F/O. P. G. Davies; P/O. A. W. Dean; Act. Flt. Lt. L. Ehrman, D.F.C.; Sgt. J. McM. Fleming; Act. Flt. Lt. H. L. Fry; Flt. Sgt. J. T. Gilchrist; F/O. M. D. L. Graham; Flt. Sgt. S. J. Griffiths; Act. Flt. Sgt. G. K. Harper; Sgt. L. Harvey; Sgt. E. Heaton; Sgt. R. Henderson; Sgt. S. Hennan; Sgt. L. Horrocks; P/O. J. Horsley, D.F.C.; Sgt. H. R. Hughes; F/O. J. E. Hussy; Flt. Lt. H. R. Hyde; F/O. B. A. James; F/O. S. H. James; Flt. Sgt. W. D. James; P/O. L. G. Jones; Sgt. K. S. Joslyn; P/O. B. J. Kearley; F/O. J. M. Keay; Sgt. P. G. Kempen; Sgt. A. Landen; Flt. Sgt. L. R. Lewis; Sgt. S. R. Loades; Flt. Lt. C. C. Lockyer; Sgt. J. R. McCourt; Sgt. R. McKerlay; Sgt. T. Martin; Sgt. W. Meikle; W/O. T. J. Mills; Sgt. J. F. Morgan; Flt. Sgt. W. G. Morgan; W/O. J. P. Morrow; F/O. J. Nelson; P/O. R. V. Newlyn; Sgt. R. T. Ottewell; Sgt. A. W. E. Pilgrim; Act. Flt. Lt. H. J. Pleydell; Sgt. C. A. Ponder; P/O. A. L. Prince; Sgt. E. E. Prince; F/O. P. J. Richards; Sgt. E. L. Richardson; Sgt. E. R. Richardson; Sgt. J. Ringwood; Sgt. H. Roberts; Flt. Sgt. J. W. Robertson; Flt. Sgt. J. W. L. Robinson; Sgt. M. Smith-Crawshaw; F/O. W. B. Robson; Act. Wing Cdr. J. D. Rollinson, D.F.C.; Sgt. W. J. Rosser; Flt. Sgt. F. Rushworth; Flt. Sgt. A. J. Sandford; Flt. Lt. P. G. Scotchmer; Sgt. T. D. Simpson; Sgt. A. H. Smallman; Sgt. J. S. Smith; Sgt. S. W. Smith; Act. Flt. Sgt. T. W. Smith; P/O. M. R. Sparrow; Sgt. R. Stamper; Sgt. W. Summers; P/O. V. H. Thompson; Sgt. J. R. Tingle; P/O. F. G. G. Tinn; Sgt. C. R. L. Todd; Sgt. J. Tye; Flt. Sgt. A. Waite; P/O. C. A. Wakley; Sgt. H. C. Walton; Act. Flt. Lt. G. A. Watling; Sgt. A. Watson; P/O. J. O. R. Webster; Sgt. S. H. Weldon; P/O. R. V. Weller; Sgt. T. Whiteley; Sgt. G. H. Williams; Act. Flt. Lt. C. T. Wilson; Act. Flt. Lt. D. C. Woodruff; Sgt. L. W. Wykes.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. A. D. Brown.

KILLED ON ACTIVE SERVICE.—Sgt. J. J. Aylott; Sgt. A. E. Chaffe; Sgt. K. Mitchell; Flt. Sgt. G. W. Oakley; Flt. Sgt. E. J. Rayner; Sgt. C. D. Ryden; Flt. Sgt. W. W. Wise.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. E. L. Padfield.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—L.A/C. T. J. Goodwin; Sgt. W. J. Ouseby.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED ON ACTIVE SERVICE.—Flt. Lt. W. R. Daddo-Langlois.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. A. M. Griffiths; Flt. Lt. S. J. Madle; Flt. Sgt. L. C. W. Paine.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. G. Brand.

DIED ON ACTIVE SERVICE.—A/C.1 D. R. Armour; Sgt. D. A. Cooper; A/C.1 E. H. Guest; L.A/C. J. A. Haylett; L.A/C. W. T. Hollis; Sgt. J. Lambert; L.A/C. J. Lewis; L.A/C. L. A. Milner; A/C.1 C. Wass.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—L.A/CW. E. West.

Royal Australian Air Force

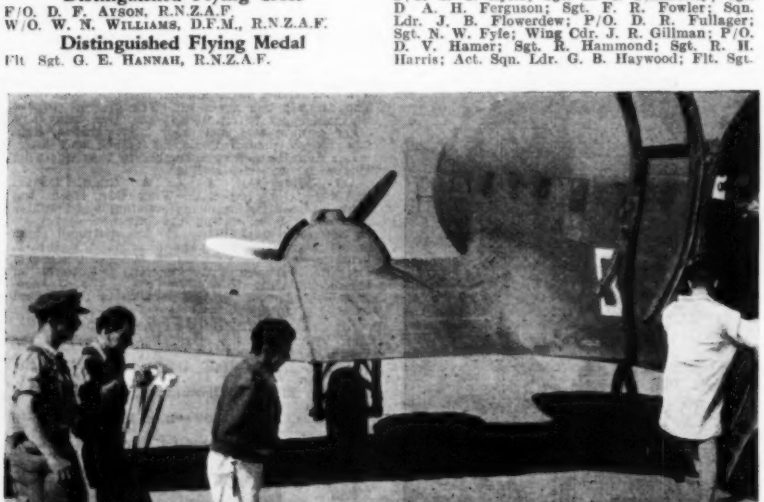
KILLED IN ACTION.—Flt. Sgt. F. E. Bowering; Flt. Sgt. K. M. F. Graham; Flt. Sgt. L. G. Laurie; Flt. Sgt. R. S. Laing; Flt. Sgt. R. J. Letcher; Flt. Sgt. D. H. Morrissey; Flt. Sgt. W. W. Rich; Flt. Sgt. W. J. Thomas; Flt. Sgt. G. M. Wood.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. P. J. Galligan; Flt. Sgt. P. W. J. Rendle.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. A. T. Fraser; P/O. R. H. Geddes; Flt. Sgt. L. T. Little.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. A. R. Davis.

MISSING.—Flt. Lt. W. G. Baldwin; F/O. W. L. Clemo; Flt. Sgt. R. R. Corcoran; F/O. I. G. Durston; F/O. K. W. P. Francis; Flt. Sgt. R. D. Gallagher; Flt. Sgt. P. K. Gericke; Flt. Sgt.



ERRANDS OF MERCY: A Douglas DC-3 takes on board Allied and German wounded to bring them back to base hospital from Italy. On the outward journey these machines carry supplies.

P. R. Gill; Flt. Sgt. C. G. Johnston; Flt. Sgt. D. B. Larkins; Flt. Sgt. R. L. Ludlow; P/O. J. Mitchell; W/O. R. DeB. Morrison; F/O. L. W. Pearse; W/O. K. E. Rimington; Flt. Sgt. J. W. A. Sutherland; Flt. Sgt. J. K. Thompson.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Sgt. F. J. Wright.

Royal Canadian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Lt. N. A. Cobb, D.F.C.; P/O. L. W. Hunt.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. D. D. Anderson.

MISSING.—Act. Flt. Lt. W. B. B. Cloutier; P/O. L. Curatolo; W/O. A. K. Lawrence; Flt. Sgt. D. S. Mullin; P/O. A. S. Parker; F/O. E. A. Sanderson.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. G. D. Thomson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. I. H. W. Baulf; F/O. J. H. Naylor; F/O. H. D. Pye.

MISSING.—W/O. G. Sole.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. K. A. Hill

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Sgt. L. K. Guthrie.

South African Air Force

MISSING.—2/Lt. B. Keyter.

KILLED ON ACTIVE SERVICE.—2/Lt. C. H. G. Ruddle.

Indian Air Force

KILLED ON ACTIVE SERVICE.—F/O. I. N. Shivapuri.

Casualty Communiqué No. 364

Of the names in this list 114 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Sgt. G. W. James; Sgt. E. Sefton; Sgt. W. J. Stephen; F/O. W. H. G. Williams; Sgt. J. A. Wilson.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. J. A. King; F/O. A. C. Smith.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. O. Beard; Sgt. W. J. Bennett; P/O. E. H. Bond; Sgt. S. Boothroyd; Sgt. B. A. Bunting; Sgt. A. J. Buxton; Sgt. D. Cameron; Sgt. G. Cameron; Sgt. J. H. Castles; P/O. C. W. Clarke; F/O. J. R. Coates; Sgt. L. N. Connor; Sgt. H. W. Cox; Sgt. P. Daly; F/O. D. H. V. Davis; Sgt. E. D. Dwelly; Sgt. E. W. Eke; Sgt. A. W. Fairmaner; Sgt. C. E. J. Frampton; Sgt. R. Freeland; Flt. Sgt. R. C. Garton; Sgt. F. L. R. Gilliver; P/O. A. P. Gilmour; Sgt. D. M. Gray; Sgt. F. C. Greening; Flt. Lt. W. Hamilton; Sgt. A. H. Hawes; P/O. A. J. Hendry; Sgt. D. C. H. Holding; P/O. E. Hough; F/O. D. G. Howse; P/O. F. H. Huntley, D.F.M.; Sgt. C. McA. Jarvie; Sgt. R. E. L. Johnson; Sgt. H. Kleiner; Sgt. G. W. Lawson; Sgt. I. Leake; Sgt. G. Lockey; P/O. G. W. Locksmith; Sgt. H. Love; Sgt. A. D. McFarlane; P/O. P. C. McNair; Sgt. D. G. Mordecai; Sgt. H. Murray; Flt. Sgt. E. J. Phelps; Act. Flt. Lt. R. C. Platt; Sgt. J. S. Porter; F/O. G. D. Priestley; Sgt. W. P. Quinlivan; F/O. W. D. Rail; Sgt. H. A. Roberts; Sgt. J. Roberts; Sgt. K. F. Shaw; P/O. G. C. Smith; Sgt W. Stephens; Sgt. A. Stott, D.F.M.; Sgt. A. J. Taylor; Sgt. R. K. Tewfik; Sgt. A. Thompson; Sgt. E. W. Thomson; Sgt. S. R. Tinkler; P/O. R. Tunstall; P/O. J. H. Warner; P/O. C. E. Wellard; Sgt. L. Whyatt; Sgt. J. Wilkinson.

WOUNDED OR INJURED IN ACTION.—F/O. F. G. D. Smith; Sgt. W. P. Watson.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. J. S. Britter; Sgt. G. C. Connon; Flt. Sgt. K. F. Paine; Sgt. L. F. Somers.

MISSING.—Sgt. D. A. Abbott; Sgt. S. Allan; F/O. F. Allison; Sgt. L. Ashton; Sgt. E. Balaam; Sgt. C. M. Baldry; P/O. A. E. Barnes; Sgt. T. G. Berry; Sgt. H. Boardley; Sgt. E. J. T. Beardman; Sgt. A. F. Brett; Flt. Sgt. E. S. Brown; Sgt. N. Butler; Act. Flt. Sgt. A. Calle; Sgt. J. T. Causier; Sgt. R. Charlton; F/O. F. E. Claydon; Sgt. L. Collins; Sgt. H. Cookman; Sgt. D. J. Coombe; Sgt. P. Cottee; Sgt. L. A. Croxton; Sgt. J. Cunningham; Sgt. J. Currie; Flt. Sgt. R. A. Deacon; F/O. A. K. Dolton; Sgt. F. H. Doncaster; Sgt. D. C. Duggan; Flt. Sgt. W. A. Dunbar; Flt. Sgt. T. W. Elder; Sgt. K. Emeny; Sgt. D. A. Ferguson; Flt. Sgt. H. Fewster; Sgt. W. J. T. Finch; F/O. K. A. M. Foottit; F/O. C. H. Glossop; Flt. Sgt. A. C. Goodwin; P/O. H. Gracey; Sgt. A. E. Grant; Flt. Sgt. J. E. Hands; F/O. R. W. Heal; Flt. Sgt. E. Hie; Sgt. F. Hilton; Sgt. H. P. Hopkins; Sgt. R. Hughes; F/O. J. Hunter; Sgt. W. J. Huntley; Act. Sqn. Ldr. J. J. Jagger, D.F.C.; Flt. Sgt. W. A. Jukes; Sgt. J. H. Kidman; Sgt. T. King, D.F.M.; Sgt. H. Landau; P/O. R. R. Last; Sgt. A. T. Lester; Sgt. D. G. J. Lucas; Sgt. J. Lynch; P/O. W. A. Lynch; Flt. Sgt. A. K. L. Lyon; Sgt. W. A. McCauley; Act. Flt. Lt. T. P. McGarry; F/O. G. I. H. McPherson; Sgt. A. J. Manthorpe; Sgt. J. J. Melling; Sgt. D. C. Mirams; F/O. I. Mitchell; Sgt. E. S. Monaghan; Flt. Sgt. G. J. Munro; Sgt. R. Nelson; Flt. Sgt. R. J. O'Connell; Flt. Sgt. E. H. Paton; Flt. Sgt. H. A. Paul; Act. Flt. Sgt. W. Percival; Sgt. F. C. Perrett; Sgt. C. A. Pinder; Act. Sqn. Ldr. T. A. Pringle; Flt. Sgt. E. W. Proctor; Act. Flt. Sgt. N. J. Raper; Flt. Sgt. D. Renton; Sgt. J. C. Reynolds; Sgt. A. M. Roberts; Act. Flt. Sgt. C. Rogers; Sgt. J. P. Rothera; Flt. Lt. J. Ruddick; Act. Wing Cdr. C. Scragg, M.B.E., A.F.C.; Sgt. J. B. Strange; F/O. G. H. Sudds; Flt. Lt. V. H. Surplice, D.F.C.; Flt. Sgt. D. R. Taylor; Act. Flt. Lt. J. G. Taylor; Sgt. A. A. Timson; Sgt. D. A. Turner; Sgt. N. D. J. Vincent; Sgt. E. S. Weatherill; Sgt. A. R. E. West; Sgt. T. F. Westmoreland; W/O. B. E. R. Whitehouse; Sgt. H. W. Williams; P/O. E. Wood; Sgt. A. W. Woodcock; Sgt. W. Woodward.

KILLED ON ACTIVE SERVICE.—Sgt. B. Ackroyd; Sgt. H. C. Birch; F/O. A. Coumbis; F/O. D. E. French; Act. Group Capt. J. Goodhart; Sgt. H. Hewitt; F/O. A. D. Holding; P/O. W. Jenkinson; Sgt. T. H. Jones; Sgt. J. Kerry; Flt. Lt. T. V. O'Shaughnessy; F/O. A. G. A. Overall; Sgt. R. A. Partridge; L.A/C. E. T. A. Pottinger; Sgt. J. F. Richards; Sgt. R. Street; Sgt. A. Thursby; Sgt. C. Tomkinson; Act. Sqn. Ldr. A. Traill; Flt. Sgt. F. Turner, D.F.M.; Flt. Lt. L. J. Woolven.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. R. E. Allen; P/O. P. C. S. Bird; F/O. T. Booth; A/C.1 E. J. Cooper; P/O. D. G. Levèn; Sgt. J. A. Scott; P/O. A. Smith.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—F/O. D. V. Bishop; Sgt. A. Brown; Sgt. W. V. Chambers; Sgt. T. B. Clarke; F/O. R. J. Coomes; Sgt. R. Dean; F/O. E. A. Embery; Sgt. E. Esau; Flt. Sgt. J. F. Forsythe-Johnson; Sgt. L. T. Gibson; Sgt. S. Godfrey; Sgt. G. Jones; Sgt. B. H. Lowe; Sgt. G. H. Potter; Sgt. N. Potts; Sgt. A. B. Stevenson; Sgt. C. E. Wright.

WOUNDED OR INJURED ON ACTIVE SERVICE.—F/O. G. A. Kendrick; W/O. I. G. Ricketts; F/O. P. J. Timmons.

PREVIOUSLY REPORTED WOUNDED OR INJURED ON ACTIVE SERVICE, NOW REPORTED DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—L.A/C. A. R. Skelson.

DIED ON ACTIVE SERVICE.—L.A/C. A. H. Cooper; L.A/C. C. D. Goodwin; A/C.2 F. Makin; A/C.1 H. L. Phillips; Sgt. R. Toach.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—F/O. N. F. Buggey; Flt. Sgt. N. Cresswell; Sgt. J. A. Lobban; P/O. J. McDonald; Sgt. F. S. Wright.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. E. A. Baldwin; P/O. L. H. M. Hadley; F/O. U. D. H. Horne; Flt. Sgt. N. R. Simpson; Flt. Sgt. J. V. Stanley.

WOUNDED OR INJURED IN ACTION.—P/O. E. W. Rogers.

MISSING.—P/O. R. N. Allan; P/O. L. D. Anderson; Flt. Sgt. W. R. Chadwick; Flt. Sgt. I. F. Chalmers; P/O. G. B. Coombes; Flt. Sgt. R. D. Hughes; Flt. Sgt. C. C. Liersch; P/O. C. O'Brien; Flt. Sgt. C. W. Reed; Act. Flt. Lt. I. J. Robertson; Flt. Sgt. W. J. Simpson; Flt. Sgt. B. H. Stevens; P/O. E. G. Thomas; P/O. C. J. Trotman; Flt. Sgt. M. R. Trout; P/O. J. W. Tylor.

KILLED ON ACTIVE SERVICE.—F/O. M. D. Gillman; Flt. Lt. D. H. F. Pitt.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. D. J. Shearman.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. J. A. Ganly.

OURS OR THEIRS: Naval airmen being taught aircraft recognition at H.M.S. *St. Vincent*.

Royal Canadian Air Force

MISSING, BELIEVED KILLED IN ACTION.—F/O. W. E. Suddick; F/O. F. J. Zubic.

KILLED ON ACTIVE SERVICE.—P/O. G. P. Johnston.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—F/O. L. E. Aspinall; Flt. Sgt. W. A. Dunleavy; Flt. Sgt. J. C. A. Hayes.

Royal New Zealand Air Force

KILLED IN ACTION.—F/O. I. A. Colquhoun.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. K. A. Burbidge; F/O. B. T. Connell; Flt. Sgt. A. J. McEwin; Flt. Sgt. D. E. Martin; Flt. Sgt. W. F. Wilcockson.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Lt. R. D. Bamford.

MISSING.—Flt. Sgt. A. J. Hannah; Act. Flt. Lt. A. Huggeridge.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Flt. Sgt. A. W. A. Bruce.

South African Air Force

KILLED ON ACTIVE SERVICE.—Lt. H. Ellis.

Casualty Communiqué No. 365

Of the names in this list 113 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—F/O. L. G. Bibdiscombe.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. M. F. Hewitt; Sgt. J. Hird; Sgt. P. J. Lavin; Sgt. E. A. W. J. Mead; Sgt. D. Purvis; Sgt. J. Rowe.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. C. B. Anderson; Sgt. J. Anderson; Sgt. G. H. Austin; Sgt. V. Bailey; Flt. Sgt. F. A. Bandy; Sgt. W. R. Beadsmoore; Sgt. J. W. Bousfield; Sgt. L. S. Broomfield; Sgt. R. J. P. Chandler; P/O. C. A. Cheese; Flt. Lt. G. A. Church; Flt. Sgt. C. Clarke; F/O. J. M. Crawford; P/O. G. Davies; F/O. R. J. Davis; Sgt. R. L. Deacon; Sgt. F. C. Detley; Sgt. M. L. S. Drabble; Flt. Sgt. R. W. Easton; Sgt. A. L. Eastwick; Flt. Sgt. S. C. Fermor; Sgt. J. S. Fletcher; Sgt. G. H. Garrard; Sgt. J. Goldflust; Sgt. R. E. Goodyear; Sgt. E. W. Hall; Sgt. A. K. Haynes; Sgt. C. B. Hemmings; F/O. A. J. Hibberd; Sgt. B. G. Hickling; Sgt. F. J. Hobbs; F/O. A. Hunt; Sgt. A. R. J. Hunt; F/O. R. Inwood, D.F.C.; Sgt. A. James; Sgt. L. W. Jones; Sgt. T. Leith-Ross; Sgt. L. Lewis; Flt. Sgt. C. L. McCarthy; F/O. B. C. McGrath; Sgt. J. N. McHarrie; Sgt. A. D. McKilligan; F/O. I. L. MacLeod; Flt. Lt. H. M. D. Magill; Sgt. W. A. Manning; W/O. E. J. Maycock; Sgt. R. W.

SERVICE AVIATION

Mepsted; Sgt. J D. Muir; F/O. T. A. Newbery; Sgt. D. C. Oliver; F/O. A. B. Orme; Sgt. G. F. Parris; Sgt. D. Parry; Sgt. D. A. F. Pavely; Sgt. J. T. Pooley; Sgt. E. H. Reader; Sgt. J. Redman; F/O. C. P. Reynolds; Flt. Sgt. J. A. Rolfe; Sgt. W. H. A. Shelvington; Sgt. C. E. Sheppard; Sgt. K. J. Smith; Sgt. J. Stephen; Sgt. J. H. Steward; Sgt. S. Sweet; Sgt. J. E. Taylor; Flt. Lt. H. D. van der Linden; Sgt. S. L. Webb; Sgt. D. Weight; Sgt. G. S. Wishart; Flt. Sgt. B. B. Wood; Sgt. P. J. Wood.

WOUNDED OR INJURED IN ACTION.—Sgt. H. Whittaker.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—F/O. W. A. Cozens; Sgt. J. McGowan; Sgt. W. L. Stockford.

MISSING.—F/O. E. J. Argent; Sgt. W. G. Atkins; Sgt. D. F. Bache; Sgt. V. G. Baker; F/O. P. B. Boulter; Flt. Sgt. G. W. Bramley; Flt. Sgt. W. H. Bryant; Sgt. C. C. Cassy; Flt. Sgt. V. N. Cawdery; Sgt. J. S. Child; F/O. S. Colbert; Flt. Sgt. C. Cook; Sgt. R. T. Cox; P/O. D. M. Davies; F/O. W. H. Davies; Sgt. L. H. Doe; Sgt. T. W. Durie; P/O. R. W. Elliott; Sgt. K. E. Evans; Sgt. N. R. J. Evans; Sgt. D. J. Ferguson; F/O. F. E. Forshew; Sgt. D. P. Fowler; Sgt. G. Fradley; Sgt. J. Galloway; Sgt. D. J. Gillam; Flt. Sgt. H. Graham; Sgt. J. T. Hadland; Sgt. R. A. Hart; Sgt. A. E. Head; Flt. Sgt. F. W. Hickman; P/O. H. B. Hill; F/O. G. V. Holmes; F/O. E. Hone, D.F.C.; Flt. Sgt. E. F. Howe; Flt. Sgt. G. C. Johnson; Sgt. K. L. Johnson; Flt. Sgt. C. J. Jones; Sgt. W. R. Jones; P/O. G. R. Ketcher; Act. W/O. C. H. Lawrance, D.F.M.; Sgt. T. R. Lee; Sgt. N. Legg; Act. Wing Cdr. N. R. Mansfield, D.F.C.; Sgt. S. F. May; Sgt. T. D. Meigh; Flt. Sgt. J. L. Miriams; Sgt. A. W. Mortimer; Sgt. A. Mosley; Sgt. D. A. Neal; Sgt. L. G. Neary; F/O. G. Palmer; Flt. Sgt. E. D. Panniers; F/O. G. W. Penrose, D.F.C.; Sgt. E. J. C. Porter; Sgt. A. J. Poulton; Sgt. A. Radley; F/O. F. G. Rosher, D.F.M.; Sgt. H. W. Rudehoff; Sgt. P. F. Searle; P/O. W. G. J. Shields; Flt. Lt. E. F. Sly, D.F.C., A.F.M.; Sgt. R. J. Standley; Flt. Lt. C. R. Stannard; Sgt. B. Stavert; Sgt. J. A. Stewart; W/O. F. Stokes; Act. Flt. Lt. C. H. Swinney, D.F.C.; Sgt. C. F. Tarr; P/O. R. S. Thompson; P/O. B. A. Trott; Sgt. C. C. Vicary; P/O. J. F. Webster; Sgt. W. E. Whitfield; F/O. R. J. Wilson.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. R. A. Andrews; Sgt. J. Johnston; Sgt. K. Talbot.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. J. P. Bartington; Sgt. R. M. P. J. Belpaire; Sgt. A. F. Cooper; Sgt. R. Hallam; F/O. H. Hoyle; Sgt. G. C. Ogilvie; Sgt. W. H. Spibey; Sgt. R. J. Teague; Sgt. F. Tempan; F/O. W. S. T. Wardrope; Sgt. A. J. Wood.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. T. G. Grosvenor; Sgt. E. C. J. Hill.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Sgt. T. W. Atkins-Tallentire; Sgt. K. K. Bell; Sgt. E. W. Durrant; F/O. J. E. Thomas.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Flt. Lt. R. F. T. Granger; Sgt. S. R. Hill.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—P/O. R. G. Gosling; F/O. E. W. Holford; Sgt. W. G. A. Venables.

DIED ON ACTIVE SERVICE.—Sgt. A. J. Deans; Sgt. L. V. Snape; A/C.1 F. Wilde; Cpl. J. C. Williscroft.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—A/CW.1 D. Whitley.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—W/O. B. G. James.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. J. J. Egan; Flt. Sgt. J. Hennessy; Flt. Sgt. W. F. Pridgeon.

WOUNDED OR INJURED IN ACTION.—F/O. D. E. W. Garvan.

MISSING.—Flt. Sgt. G. Armitt; P/O. E. C. Bagot; P/O. D. C. Balfour; Act. W/O. V. A. M. Hedges; Flt. Sgt. S. E. James; Flt. Sgt. L. J. McCarthy; Flt. Sgt. R. C. Strange; Flt. Sgt. A. K. Trevena.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. J. K. Callow.

Royal Canadian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. D. R. Agnew; Flt. Sgt. D. E. Campbell; Flt. Sgt. W. A. Hood; Flt. Sgt. H. C. Jordan; F/O. R. G. McKessock; F/O. W. B. Mayes; Sgt. C. W. Price; Flt. Sgt. W. R. Townsend.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. C. A. Balcer; Flt. Sgt. S. D. Bird; Sgt. M. R. Deverill; P/O. C. H. Dunn; Flt. Sgt. H. S. Hicks; Sgt. P. Hollyer; Flt. Sgt. C. W. Keay; Flt. Sgt. J. M. C. Legace; P/O. E. J. Monk; Flt. Sgt. L. F. O'Leary; Flt. Sgt. E. B. Peart; Flt. Sgt. J. A. Pirie; F/O. A. E. Pourbaix; F/O. R. M. H. Purdon; Sgt. W. J. Reid; Flt. Sgt. C. N. Roy; F/O. J. T. Wills.

WOUNDED OR INJURED IN ACTION.—W/O. E. A. MacKay.

MISSING.—Act. Sqn. Ldr. E. S. Alexander, D.F.C., D.F.M.; F/O. A. A. Ayres; W/O. R. L. Baxter; Flt. Sgt. T. J. Beechinor; Flt. Sgt. D. W. Bowell; F/O. C. S. Brest; Sgt. N. E. Carter; Flt. Lt. D. A. Claydon; F/O. J. T. Clinkskill; W/O. J. G. Coffin; P/O. N. E. Cook; Flt. Sgt. F. W. Crossley; Sgt. P. R. A. Dack; Sgt. M. G. E. Donoghue; Sgt. W. J. Douglas; Flt. Sgt. N. G. Dowler; F/O. W. C. Drumm; Flt. Sgt. B. E. Findlay; P/O. B. N. Forster; Flt. Sgt. A. L. P. Gibson; Flt. Sgt. W. A. Glover; F/O. M. Gnius; W/O. E. S. Hawkes; W/O. W. H. Hoppus; F/O. D. R. Hunter; Flt. Sgt. J. M. Hunter; Flt. Sgt. R. A. Kerr; W/O. H. H. Kinghorn; F/O. F. E. Lampin; F/O. L. F. Legace; P/O. D. T. Lyng; Sgt. E. W. H. McCaffrey; Flt. Lt. L. N. McCaig, D.F.C.; Flt. Sgt. D. A. McDonald; F/O. W. R. McGregor; Sgt. J. A. McKenna; Flt. Sgt. P. J. Maher; F/O. J. B. Mahoney; F/O. J. L. Martin; Flt. Sgt. F. R. Moffat; Sgt. J. R. Morgan; Flt. Sgt. G. C. Mould; P/O. R. J. Orr; F/O. H. D. Paddison; P/O. V. Parrott; F/O. S. W. W. Perry; Flt. Sgt. W. A. Peterson; P/O. R. D. Polson; Flt. Sgt. D. A. Powley; W/O. T. J. Preece; Sgt. B. C. Prill; P/O. D. A. Rae; F/O. J. M. Ramsay; Sgt. F. G. Sanderson; F/O. R. G. Selman; F/O. W. R. Sloan; F/O. E. W. Smith; F/O. J. A. Sneddon; Flt. Sgt. H. W. Spackman; W/O. S. G. Stephenson; P/O. E. H. Thomas; Flt. Sgt. R. H. Thompson; Flt. Sgt. R. E. Williams; Flt. Sgt. A. M. Wilson.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. C. W. Christie; Flt. Sgt. W. A. Houston; Flt. Sgt. W. J. Hynes.

KILLED ON ACTIVE SERVICE.—F/O. W. L. Boisvert; W/O. G. E. Giff; Sgt. G. H. Hivon; Sgt. R. G. Kimball; F/O. J. P. Lavallee; Flt. Sgt. G. C. Munro; F/O. W. Phillips; Flt. Sgt. R. D. Poe; F/O. W. J. Rogers; F/O. C. L. Spooner.

WOUNDED OR INJURED ON ACTIVE SERVICE.—F/O. F. H. Baker; Flt. Sgt. F. C. Biddle.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Flt. Sgt. L. Petry; Flt. Sgt. J. H. Sharpe.

Royal New Zealand Air Force

MISSING.—F/O. W. L. Harvey, D.F.M.

KILLED ON ACTIVE SERVICE.—P/O. S. G. Johnson, D.F.C.

Casualty Communiqué No. 366

Of the names in this list 109 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Sgt. R. H. Davies; F/O. R. H. Edmeades; Sgt. M. N. Jones; Flt. Sgt. P. F. Kennedy; Sgt. G. W. McNab; Flt. Sgt. T. Owen; P/O. L. T. Puddephat; Sgt. B. F. Turner.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. S. H. Burrows; Sgt. C. D. Herbert.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. L. Ashworth; Sgt. A. J. Banfield; Sgt. W. E. Barley; Sgt. W. G. Berry; Sgt. S. Biddulph; F/O. E. N. Billington; Sgt. A. J. Boar; Sgt. S. T. Booth; Sgt. C. Boughton; Sgt. C. A. Britton; Sgt. J. Brown; Sgt. P. Butterworth; Sgt. G. C. Chapman; Sgt. H. T. Clarke; Sgt. K. B. Coulter; P/O. E. F. Curtis; Sgt. C. C. Dabson; Sgt. J. J. Davis; Sgt. R. T. Davis; Sgt. A. Derbyshire; Sgt. F. F. Foden; Sgt. H. McA. Frew; Sgt. G. W. Fuller; Sgt. K. W. Gadsdon; Sgt. A. E. J. Gibbs; Flt. Sgt. E. K. Hart; Sgt. W. Hart; Sgt. G. J. Holt; Flt. Sgt. M. D. Horner; Sgt. J. M. Hurson; Sgt. H. A. Horrell; Sgt. H. E. Jones; Sgt. A. F. Lane; F/O. E. E. Lawton; Sgt. B. E. Lewis; Sgt. G. A. Livett; Flt. Sgt. T. J. MacAulay; F/O. A. J. Manning; Sgt. J. L. Marlow; Sgt. J. P. Martin; Sgt. F. C. Maxwell; Sgt. A. Monaghan; Sgt. K. D. S. Mordecai; Sgt. A. M. Morgan; Sgt. N. K. Newham; Sgt. T. Ogle; P/O. M. E. Rust; F/O. E. Sanderson; Sgt. C. C. D. Scotney; Flt. Lt. F. P. Seward; F/O. E. G. Simonds; Sgt. D. H. N. Slinger; Flt. Sgt. D. Smart; Flt. Sgt. K. I. Smith; Sgt. T. Smith; Sgt. E. C. Stally; Sgt. A. F. Stephens; Sgt. B. S. Swainston; Sgt. G. Taylor; Sgt. A. B. Thomas; Sgt. L. Turvey; Sgt. G. H. Wager; Sgt. J. Walker; Sgt. D. M. T. Watts; F/O. F. G. Whelpdale; Sgt. H. C. Williams; Sgt. R. A. Williams; Sgt. S. Williams; Sgt. A. C. Woodley.

MISSING, BELIEVED KILLED IN ACTION.—F/O. J. Gilhespy.

MISSING.—F/O. A. F. Abbott; Flt. Sgt. R. A. Adams; F/O. L. R. Allen; F/O. P. R. Bales; Sgt. K. W. J. Baxter; Sgt. D. L. F. Bellamy; Sgt. E. G. Bird; Sgt. A. Blanksby; Sgt. H. W. Bloomfield; Sgt. D. M. Board; P/O. H. E. Borrow; Flt. Sgt. H. Boyes; Sgt. J. Bremner; F/O. L. F. Brewer; Sgt. E. W. Brookes; Flt. Sgt. R. Brotherton; Sgt. H. E. Bryce-Jeffrey; Sgt. F. Buchan; Sgt. K. Butler; P/O. D. Canning; P/O. E. A. Church; Sgt. P. P. Clarkin; Sgt. R. T. Compton; Flt. Sgt. A. W. Coote; Flt. Sgt. N. Cottrell; Sgt. R. S. W. Cowdrey; Sgt. K. S. Criseld; Sgt. I. Davies; F/O. J. C. H. Davies; Sgt. E. J. Devine; Flt. Sgt. R. Dudley; Flt. Sgt. T. W. Edwards; Sgt. A. E. Elliott; Sgt. E. W. B. Evans; Flt. Sgt. K. E. L. Farmelo; Sqn. Ldr. C. J. Farmery, D.F.C.; Sgt. J. M. Fisher; Sgt. R. A. Forte; Sgt. C. Gilroy; Sgt. W. J. Gowdy; Sgt. B. A. B. Graham; Flt. Sgt. J. W. Gregory; Sgt. G. E. Grigg; Sgt. J. D. Groves; P/O. W. H. F. G. Hagon, D.F.C.; Sgt. H. S. Harrison; F/O. D. F. Henshaw; Sgt. K. A. Hicks; Sgt. J. Hill; Sgt. G. Ibbotson; Flt. Sgt. H. D. Jones; Sgt. S. J. L. Jones; Sgt. J. R. Keenen; F/O. D. H. Kent; Sgt. W. Kingham; Flt. Sgt. E. A. Lane; F/O. J. Lockhart; Flt. Sgt. D. J. Lowe; Sgt. P. Lynch; P/O. R. H. Megainey; Flt. Sgt. E. D. MacPherson; Sgt. J. McCurry; Sgt. D. L. Mansfield; Sgt. F. Martin; Sgt. A. Mickus; Flt. Sgt. A. E. Millard, D.F.M.; Flt. Sgt. L. N. Millis; Sgt. D. R. Mills; Sgt. J. T. A. Mitchell; F/O. H. D. G. Morris; Sgt. P. Moss; F/O. F. W. Newson; Act. W/O. G. Peasgood; Flt. Sgt. D. J. Phelan; Sgt. V. M. Piedot; Sgt. D. E. Pinkard; Flt. Sgt. C. F. Plumb; Sgt. A. C. Pope; Sgt. A. Pratt; P/O. C. Rankin; F/O. G. M. Reid; Sgt. R. Richards; Flt. Sgt. S. J. Richards; Sgt. R. Richardson; Act. Flt. Lt. F. J. Roberts; Act. Flt. Lt. W. G. Ross; Sgt. J. W. Shelton; Flt. Sgt. H. F. Smith; Sgt. K. F. Stanbridge; Sgt. T. G. Stammers; Sgt. J. R. Starr; Sgt. J. M. Townsend; Flt. Sgt. A. B. Tuttle; Sgt. P. V. De V. Vickers; Flt. Sgt. G. Walker; Sgt. A. E. Watkins; Sgt. L. G. W. Watts; Sgt. E. Weatherley; Flt. Sgt. F. T. West; Sgt. R. T. Western; Flt. Sgt. S. B. Wheatley; P/O. G. G. A. Whitehead; Sgt. J. S. Whittle; P/O. J. E. Williams; Sgt. F. Wilson; F/O. D. T. Wood; Flt. Sgt. G. Young.

KILLED ON ACTIVE SERVICE.—P/O. R. T. H. Ellis; F/O. D. A. Page.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. N. J. Cooke; Sgt. D. Worthington.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—L.A/C. R. Wilkes; P/O. J. F. L. Wise.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED ON ACTIVE SERVICE.—P/O. N. C. Harris.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. J. Alcock; P/O. R. B. Turvey.

Royal Australian Air Force

KILLED IN ACTION.—P/O. J. R. Markey; Flt. Sgt. J. C. Shipard.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. G. J. Black; Flt. Sgt. F. McGlinchy; P/O. J. S. Henderson; Flt. Sgt. R. S. Hogben; P/O. I. S. McLennan; P/O. C. F. Tozer; Flt. Sgt. M. A. B. Watkins; P/O. R. F. Westwood.

MISSING.—F/O. L. R. Boag; Flt. Sgt. W. R. Chapman; P/O. J. F. Howell-Price; Flt. Sgt. J. P. Irwin; Act. Flt. Lt. R. King, D.F.C.; Flt. Sgt. P. A. Marsh; Flt. Sgt. E. D. Moncrieff; Flt. Sgt. T. R. Rogers; Flt. Sgt. L. C. Taylor.

Royal Canadian Air Force

KILLED IN ACTION.—F/O. J. A. Vasicek.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. J. V. Agate; P/O. R. J. Bryans; P/O. J. G. Budreau; Act. Flt. Lt. R. H. P. Gamble; W/O. G. B. Jackson; F/O. D. J. MacMillan; Sgt. W. A. McNair; Sgt. J. T. Macksinchuk; Act. Flt. Lt. L. B. Maddex; Sgt. H. V. Smith-Jones; Sgt. B. E. Watt.

MISSING, BELIEVED KILLED IN ACTION.—F/O. M. A. Decloux.

MISSING.—W/O. R. A. Billings; F/O. D. C. E. Bradshaw; Sqn. Ldr. E. W. Cowan; Sgt. G. Currie; W/O. C. L. Depper; Sgt. J. H. Dipinto; Flt. Sgt. C. G. Dupueis; Flt. Sgt. W. J. K. Fletcher; F/O. R. W. Gilkey; Flt. Sgt. R. J. Irvine; F/O. J. A. Linde; Sgt. R. B. Livingstone; Flt. Sgt. B. J. Lobb; Flt. Sgt. W. J. Louth; F/O. R. B. McClellan; P/O. J. C. MacGillivray; Sgt. A. W. McGrath; F/O. D. A. MacGregor; W/O. J. P. S. McLeod; W/O. J. McTrach; W/O. W. P. Morris; W/O. W. A. Parsley; F/O. G. I. Ransom; F/O. W. R. Reed; F/O. J. H. Seymour; Sgt. E. Smith; Sgt. N. Smith; Sgt. S. J. Smith; W/O. D. A. Thomson; Flt. Sgt. G. W. C. Toal; W/O. C. Z. Toupin; Flt. Sgt. J. A. Wilson; W/O. O. P. Varnold.

Royal New Zealand Air Force

KILLED IN ACTION.—F/O. A. A. Brown.

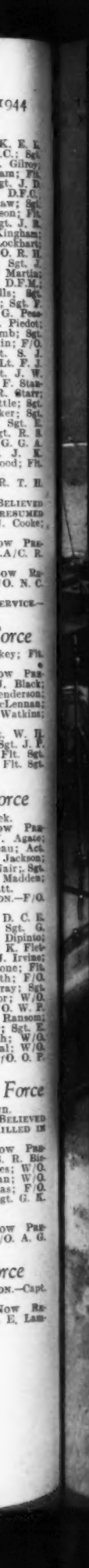
PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. A. W. Wood.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. S. R. Bisset; F/O. D. R. Hall; Sgt. O. A. Innes; W/O. S. L. Kavanagh; Flt. Sgt. W. P. Lanigan; W/O. H. McKinnon; Flt. Sgt. G. A. Mathias; F/O. M. J. Mills; Sgt. T. B. Rimmer; Flt. Sgt. G. K. Samson; Flt. Sgt. I. M. Sykes.

MISSING.—Flt. Sgt. R. R. J. Simpson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—P/O. A. G. Cleary.

South African Air Force

MISSING, BELIEVED KILLED IN ACTION.—Capt. H. J. Buch; Maj. W. J. Wheeler.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Air Sgt. E. E. Lambert.